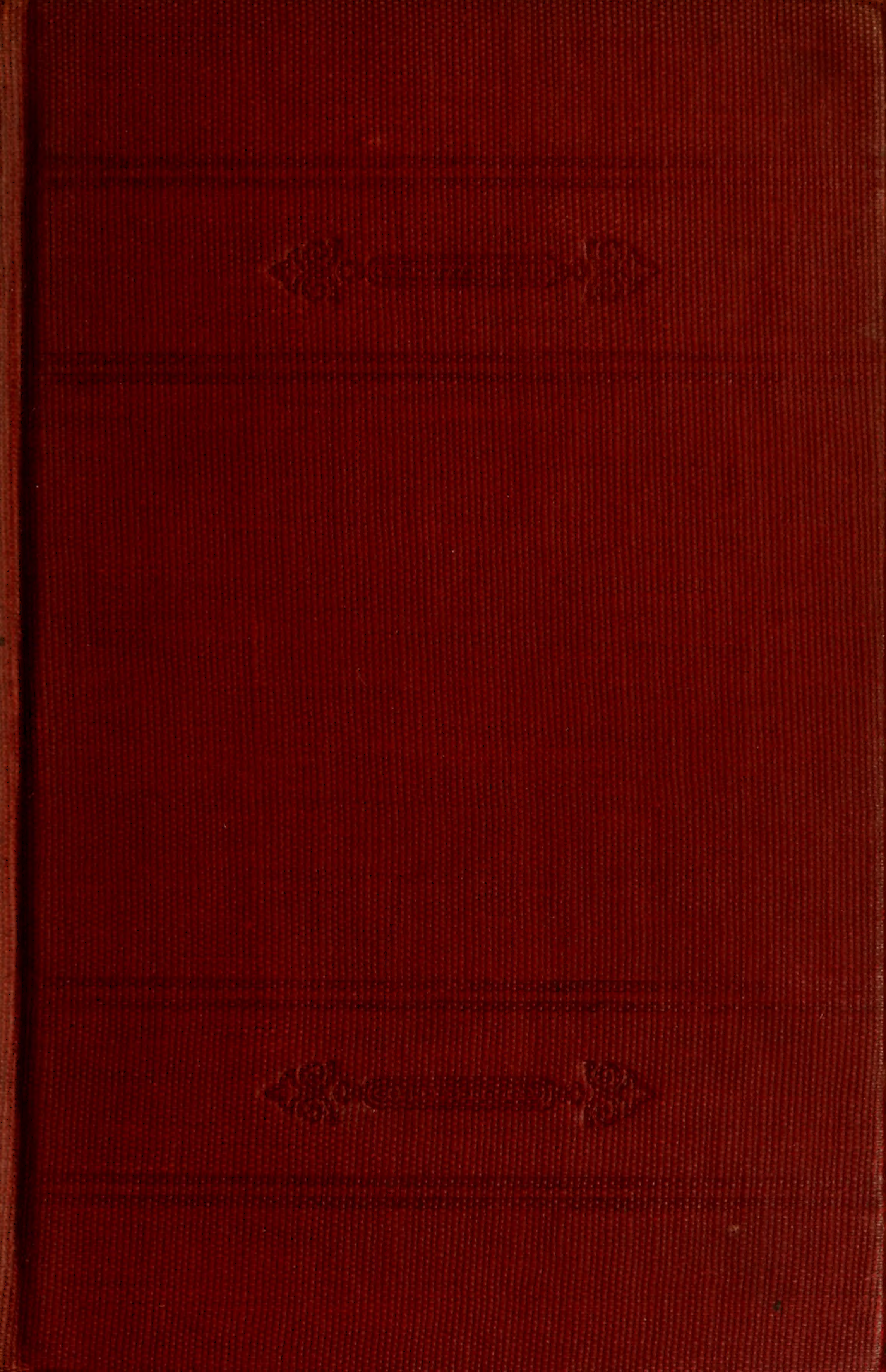

BUREAU OF FISHERIES

REPORT
OF THE
UNITED STATES COMMISSIONER OF FISHERIES

FOR THE FISCAL YEAR 1920

WITH

APPENDIXES

HUGH M. SMITH
Commissioner

DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

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The fisheries biological station at Fairport, Iowa. By R. E. Coker. Appendix I, 12 pp., 4 figs., 3 pls. (Document No. 895. Issued May 17, 1921.)

Progress in biological inquiries. Report of the division of scientific inquiry for the fiscal year 1920. By R. E. Coker. Appendix II, 32 pp. (Document No. 896. Issued December 16, 1920.)

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REPORT OF THE
UNITED STATES COMMISSIONER OF FISHERIES
FOR THE FISCAL YEAR ENDED
JUNE 30, 1920

BUREAU OF FISHERIES.

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REPORT

OF THE

COMMISSIONER OF FISHERIES.

Department of Commerce,
Bureau of Fisheries,
Washington, September 15, 1920.

Sir: I have the honor to present herewith a report which gives an outline of the major operations of the Bureau of Fisheries during the fiscal year ending June 30, 1920. The Bureau's functions are comprehended under eight captions, namely, relations with the fishery industries, biological investigations, propagation and distribution of food fishes, artificial propagation of fresh-water mussels, Alaska fishery service, Alaska fur-seal service, minor fur-bearing animals of Alaska, and general administration considerations, for each of which there follows a brief discussion. A number of special reports covering the Bureau's various activities have been issued and may be consulted by those who desire details.

It may be noted that the Bureau has reached the fiftieth year of its existence, having been established in February, 1871. Its growth from a mere commission charged with investigatory functions has been phenomenal, and the half century closes with the Bureau occupying a larger sphere of usefulness than ever before and prepared to render a more important service to the fishing industry and to the general public, but with its powers curtailed by a grossly underpaid staff and by inadequate appropriations for essential features of the work.

FISHERY INDUSTRIES.

GENERAL CONSIDERATIONS.

The general condition of the American fisheries may be characterized as unsettled. While the world-wide cry has been for increased food production, and the fisheries have responded to the cry, there has been an underconsumption of fish in the country at large, and millions of pounds of food fish have been wasted or put to economic uses of lesser importance. While the prices of foodstuffs almost without exception were rising during the past year, in at least one of the great fisheries, namely, the New England vessel fisheries, there was a falling off in prices received by the fishermen as compared with the previous year.

The Bureau, through its division of fishery industries, has rendered meritorious service in reducing waste, in effecting improvements in methods of preservation and distribution, in securing larger production of aquatic products, and in increasing the public appreciation of and demand for fish as food. The Bureau is in position to render still further and much-needed service in various fields. It has the equipment, the directing personnel, the conception of the problems, and the knowledge of the best ways of approach. The chief requirement is an adequate appropriation.

The past year has been noteworthy for the increasing attention given to the commercial possibilities of the fishery industries, to providing means for increasing production, to effecting improvements in preparation of the products for market, and to the saving of the by-products of the fisheries for use in the arts and industries. This widespread interest has resulted in increasing the demands upon the Bureau for trustworthy and detailed information regarding the fisheries, products, and processes; for the conduct of technological investigations which properly come within its sphere of operations; and for guidance and assistance in the upbuilding of certain fisheries without endangering the harvests of the future. Because of its limited appropriations it has been unable to meet many of these demands in the manner they deserve. This is especially true of the calls for various technological investigations to solve difficulties encountered in the preservation or utilization of certain fishery products and for educating the public as to the merits of fish as food, particularly the little-known varieties. For lack of such work large quantities of valuable protein food, the high-priced element of our diet, are being wasted at a time when there is particular need for the practice of economy and saving.

The Bureau has conducted a number of important investigations, as, for example, a study of the basic principles governing the preservation of fish with salt, experiments in the recovery of old brine and salt for reuse, development of methods of canning the Pacific mackerel and other abundant but neglected fishes of the west coast, preliminary studies of some features of freezing fish in brine, and the possibility of producing pearl essence from the scales of native fishes. Practical application of the results of its investigation in the salting of fish have been made and canners have been supplied with information gained in its temporary canning laboratory at San Pedro, Calif. Material aid has been given in the development of certain fisheries, such as those for sharks and porpoises; in increasing the use of by-products of the fisheries; in extending the production of fish oil, scrap, meal, leather, etc.; in determining to what uses various products are best suited; and in supplying information regarding sources of supply and possible markets for the finished products. A study of foreign methods of preserving nets has been made and a paper has been prepared for publication for the use of our fishermen in effecting economies in their expenditures for nets. Encouragement has been given to determining the practicability of using seaplanes in locating schools of fish, and arrangements have been made through the Navy Department for sending out planes for this purpose to enable those in the industry to determine their value as a commercial undertaking.

In the collection and dissemination of statistical information regarding the fisheries more has been accomplished than in any recent year. The Bureau has completed a canvass of the coastal fisheries of the South Atlantic and Gulf States for the calendar year 1918 and has prepared for publication detailed statistics of fisheries of the Gulf States for that year and of the fisheries of the Great Lakes for 1917, together with the results of canvasses of the shad fishery of the Hudson River and of the shad and herring fisheries of the Potomac River for 1919, completed during the year. The monthly returns of the quantities and values of the fish landed at Boston and Gloucester, Mass., Portland, Me., and Seattle, Wash., by American and Canadian vessels have been collected by local agents, tabulated, and published as monthly and annual bulletins for the use of the trade and to serve as a permanent record of the condition and trend of these important fisheries. Through the courtesy of the Health Department of the District of Columbia the Bureau has continued to receive daily reports of the quantity of fishery products received at the municipal fish wharf and market at Washington, D. C. These have been tabulated for the calendar year 1919 for publication. In addition a canvass of the fisheries of the New England States for 1919 has been begun.

A report of the work of this division for the calendar year 1919 containing a detailed account of investigations, the relations of the Bureau with the fisheries, and full statistical tables and discussions, has been prepared by the assistant in charge and issued as a public document entitled "Fishery Industries of the United States: Report of the Division of Statistics and Methods of the Fisheries for 1919." Persons desirous of obtaining such detailed information should consult this report.

UTILIZATION OF BY-PRODUCTS OF THE FISHERIES.

Inadequacy of supply of various nonfishery products has materially increased the demand for by-products of the fisheries possessing similar qualities. To this class belong fish oils for admixture with other drying oils in the manufacture of paints and varnishes, for purposes of hydrogenation and the like; fish scrap for use as an ingredient in fertilizer; meal for use as an animal feed; leather made from fish hides; and poultry grit from ground oyster shells. To meet these demands the Bureau has given a larger measure of attention to encouraging the saving of the by-products of the fisheries, to the solution of problems arising from efforts to put these products to new and more important economic uses, and to supplying information regarding sources of supply, methods of manufacture, uses, and markets.

Analyses have been made of the body and liver oils of various species of sharks and skates, albacore or tuna, and yellow-tail oils to determine more definitely their properties and possible uses. Samples of these oils were also furnished the educational bureau of the Paint Manufacturers' Association of the United States to determine their suitability for use in the manufacture of paints and varnishes. From drying tests of tuna oil made by the director of that association, it appears that this oil dries even more rapidly than linseed oil. The yield of oil from the tuna fisheries in southern California in 1919 is estimated at slightly in excess of 100,000 gallons. The oil of the yellow-tail (*Seriola dorsalis*) proved as satisfactory as menhaden oil but was not the equal of tuna oil for drying purposes.

Persons employed in the fisheries have been urged to convert unutilized stocks of fish waste into scrap for fertilizer, or preferably into fish meal, with the result that provision is being made for the more extended saving of this material. For example, until recently not more than half of the waste from the shrimp industry of the South Atlantic and Gulf States was saved, being converted into fertilizer which commanded a relatively low price. Feeding tests made by the Bureau of Animal Industry of the Department of Agriculture in cooperation with the Bureau of Fisheries indicate that shrimp bran, properly prepared, is fully the equal of fish meal for feeding hogs. This information has been brought directly to the attention of persons in the shrimp industry, and improved methods for the preparation of shrimp bran are being perfected, resulting in the saving of much larger quantities of this valuable material than formerly. From analyses it appears that shrimp meal may be expected to contain from 43 to 47 per cent of protein. There are indications that as feed it possesses other properties which tend to increase its value for such purposes.

As a direct result of these activities, in excess of 2,500 tons of menhaden meal and shrimp meal were produced in 1919, with prospects for a rapid annual increase in the output of these commodities in regions where heretofore they were unknown. In this field the Bureau has continued to receive effective cooperation from the Bureau of Animal Industry in the conduct of feeding tests of various kinds of fish meals, in deciding their suitability for feeding purposes, and in bringing to the attention of hog growers the value of these protein feeds. To properly safeguard the industry a number of additional feeding tests have been arranged for and will be started in the near future. These will include shrimp meal from drying platforms, shark meal, meal made from fish cuttings, and meals containing high percentages of oil or made from decomposed fish.

Satisfactory progress in the production of leather from fishskins and the establishment of fisheries for sharks and other unused aquatic animals are to be recorded, and provision has been made for determining more definitely the special properties of such leathers for the use of the trade. It is to be noted that the demand for dried shark fins, which the Bureau has stimulated, now exceeds the supply. The receipt of this commodity at San Francisco, the center of the industry on the Pacific coast, amounts to about 5 tons per month, much the larger portion being imported from the west coast of Mexico. Persons engaged in fisheries for sharks or fisheries in which sharks are incidentally taken are being urged to save all parts of these fishes and are furnished with detailed information on the subject

INVESTIGATION CONCERNING PRESERVATION OF FISH WITH SALT.

The preliminary investigation of the principles of preserving fish with salt has been completed and the results have been published (as Bureau of Fisheries Document No. 884) and made available to all persons interested in the subject. This work has been of material benefit in clarifying our knowledge of the factors influencing salting processes, and therefore in pointing the way to possible improvements in existing practices. Among other things it has shown that the purer salts, which contain only a fractional per cent of impurities such as lime and magnesium, penetrate the tissues of the fish more rapidly than salts containing a higher percentage of such impurities; and that salt penetrates fish packed in dry salt faster than if packed in brine, and through the flesh faster than through the skin, thus revealing the value of cutting or splitting the fish. As the blood spoils at a lower temperature than the flesh, it is important to thoroughly wash out the blood if the salting is attempted at high temperatures. The investigation was conducted on a laboratory scale, and did not include studies of the factors determining the length of time salted fish will keep or other important lines of research, such as determinations of the fat content of fish, the practicability of improving the general quality of salt fish, and means for increasing the demand for such products by the consuming public. Such investigations may be expected to reveal means for preventing or safeguarding against spoilage and in other ways render the industry material service.

One of the objects of the original investigation was to determine the practicability of salting fish at high temperatures, and therefore in warm climates. To give practical application to the results, the Bureau gave demonstrations of its methods to fishermen at points in Florida, where previous attempts at salting by the usual practices had resulted in failure through the spoilage of the product. For this work it employed a practical salter, with many years' experience in salting river herring, gave him careful training in its methods and objects, and detailed him to Florida to instruct fishermen desirous of salting river herring in this manner. As a result 80,000 fish were successfully salted, and brokers and dealers handling the product expressed themselves as highly pleased with its quality. As indicative of the importance of adhering rigidly to the method prescribed, it should be noted that every attempt of the packers to depart from that method resulted in the loss of the fish. The salting of the fish was so successful that the packers are preparing to engage in this new branch of the industry on a large scale, so as to make possible the shipment of fish in car lots.

PRESERVATION OF FISHERY PRODUCTS BY CANNING.

Since May, 1919, the Bureau has been conducting at San Pedro, Calif., experiments in the preservation of fishery products by canning. It has devoted its attention particularly to little used fishery products for which satisfactory canning methods have been lacking and to the establishment of standard methods which will yield standard packs. The mackerel (*Scomber japonicus*), an abundant fish but little esteemed on the California coast, has received more consideration than other species. Over 80 different packs of this fish have been put up and subjected to careful examination, with the result that a number of promising methods have been developed, several of which have been released for the use of the trade. Other species experimented with are bonito, barracuda, pilchard, sea bass, smelt, tunas, and yellow-tail, several hundred packs of the various species having been put up and held in storage for examination periodically. A number of special problems have been encountered in the course of this work which may require rather extended study before a solution is found, as, for example, the unpleasant odor and taste in canned bonito and the detinning of cans in packs of such fish as the barracuda. A vital desideratum of the Bureau, if it is to fulfill its functions and render the largest measure of service to the fisheries, is adequate provision in the matter of personnel and funds to enable it to render the canning industry of all sections aid in the preservation of crabs, shrimps, turtles, and certain fishes, and determining more definitely the possibility of applying newer methods in the case of staple canned fishery products. The need for accurate data in these fields is well shown by the large number of requests that the Bureau receives.

PRESERVATION OF FISH NETS.

Outside of Norway very little investigation or experimentation has been done on the preservation of fish nets. In that country considerable attention has been given to developing new methods and improving old ones. This important means of economizing in the expense of nets seems to have been neglected in the United States, where the only preservative employed to a considerable extent is tar, the use of which is confined to the coarser kinds of nets. As a basis for future investigative work and for the immediate benefit of the American fisheries, one of the Bureau's assistants has reviewed the literature on the subject, assembling important scientific data and tests for publication. Some of the more common and efficacious preservatives used for such purposes are catechu, quercitron, or other tanning extract, linseed oil, tar, and soap, followed by soaking in a solution of copper sulphate.

It may be pointed out that one of the important functions of the Bureau is to make available to fishermen the scientific and practical experiences of foreign countries. Through such studies of the foreign literature, results of great value may be obtained for direct use in the industry or as the basis for additional experimental work in our fishery products laboratory.

USE OF AEROPLANES IN THE FISHERIES.

The possibility of practical use of aeroplanes in various branches of the fisheries is one of the most interesting developments in aviation. The most obvious purpose that aeroplanes may serve is in the offshore fisheries in determining the location of whales and schools of surface-swimming fishes, like mackerel and menhaden, and in promptly communicating this information to fishing vessels or to shore stations. Other uses of aircraft in connection with the fishing industry will doubtless arise.

In April, 1919, it was suggested to menhaden companies operating in the Chesapeake Bay region and having vessels that frequent the grounds off the Virginia capes that seaplanes might be used advantageously in helping the fishermen find fish. Desirous of determining the practicability of the commercial use of aeroplanes in the fisheries, the Bureau was instrumental in bringing about an arrangement between the Naval Aviation Service and the menhaden fishermen whereby naval seaplanes were made available for observation flights in quest of menhaden. Subsequently radio apparatus was installed on two menhaden vessels and at a factory on Chesapeake Bay, so as to be able to communicate with the seaplanes; the offshore fishing grounds were blocked off in numbered squares on charts; and two naval seaplanes, each with a fisherman-observer, have been traversing the fishing areas and reporting the location of schools of fish. The early results have been satisfactory, as the seaplanes have readily found fish and acquainted the fishermen with their location and abundance, thus saving much time and expense that would ordinarily be required for cruising.

If this experiment continues to meet with the initial success, there is reason to believe that aeroplanes may take a permanent place in the menhaden fishery and doubtless in other branches. Inasmuch as the investment in planes and radio apparatus and the salaries of observers, pilots, and radio operators might be too burdensome for a single company to assume, it may be to the advantage of the industry for communities or groups of interests to provide for such service in common.

MISCELLANEOUS INVESTIGATIONS.

In addition to the technological studies already mentioned, the Bureau has supplied many inquirers with information and helpful suggestions regarding technological methods and processes, thereby rendering an important service in the upbuilding of the industry. The Bureau also has given attention to the development of methods for the recovery and reuse of salt and brine that have been employed in preserving fish; to an examination of possibilities of certain foreign methods of freezing fish in brine; to the methods of producing pearl essence from the silvery scales of native fishes, and to tests of the practicability of putting noncommercial sponges to commercial use. Pearl essence or liquid nacre ("essence d'orient") which is claimed to be superior to the imported product, of which large quantities are consumed in the United States, is now being made from the scales of river herring. The prices received by the fishermen are sufficiently high to induce them to save this hitherto waste product.

The equipment of the fishery-products laboratory in Washington has served the needs not only of the Bureau's own investigators but of other branches of the Government service. For example, use has been made of its brine-freezing plant by representatives of the Bureau of Plant Industry for freezing strawberries and cherries for comparison with the air-frozen product, and its air-freezing plant by the Bureau of Standards for the conduct of tests under various low-temperature conditions.

NEW ENGLAND VESSEL FISHERIES.

Through its local agents at Boston, Gloucester, and Portland, the Bureau has obtained and disseminated statistical and other information regarding the great vessel fisheries centering at those ports. These fisheries in 1919 were in a prosperous condition, although the number of trips and catch were not so large as in the previous year.

During the calendar year 1919 this fleet numbered 523 sail, steam, and gasoline screw vessels, including 25 American and 2 Canadian steam trawlers. These vessels landed at Boston 2,754 trips, aggregating 103,391,370 pounds of fish, valued at $4,713,350; at Gloucester 2,965 trips, aggregating 71,370,957 pounds, valued at $2,145,592; and at Portland 2,550 trips, aggregating 21,718,943 pounds, valued at $689,441. The total for the three ports was 8,269 trips, aggregating 196,481,270 pounds of fresh and salted fish, having a value to the fishermen of $7,548,383.

The foregoing total includes 39 trips, 26 at Boston and 13 at Portland, landed by nine Canadian fishing vessels, comprising 3,296,147 pounds of fresh fish, valued at $106,261. Of this quantity, 1,191,845 pounds, valued at $53,653, were landed at Boston, and 2,104,302 pounds, valued at $52,608, at Portland. There was a decrease of 12 vessels, 21 trips, and 2,306,602 pounds in quantity and $112,364 in the value of the products as compared with the previous year's status of this Canadian fishery. These fish were brought into our ports in accordance with an arrangement with the Canadian Government, as an emergency war measure granting reciprocal privileges to fishing vessels, by which Canadian fishing vessels were permitted to land their fares at American ports direct from the fishing grounds. Canadian fishing vessels began to utilize this privilege in April, 1918, and the arrangement is still in operation.

During the year 1919, 24 American fishing vessels made 29 trips with 434,486 pounds of fish at Canadian ports on the Atlantic coast, of which 8 trips by 8 vessels comprising 312,036 pounds were landed at Halifax, Nova Scotia. Incidentally, it may be noted that under the reciprocal arrangement 173 American fishing vessels landed 915 trips, amounting to 12,258,522 pounds, at Canadian ports on the Pacific coast, of which 889 trips by 154 vessels, aggregating 10,804-522 pounds, were discharged at Prince Rupert, British Columbia.

Compared with the previous year, there was a decrease of 481 trips, or 5.49 per cent, in the total number landed by the fishing fleet at Boston, Gloucester, and Portland, and of 9,019,883 pounds, or 4.38 per cent, in the quantity, and $2,983,165, or 28.32 per cent, in the value of the fish landed. The only important species showing an increase in catch over the previous year were haddock and halibut. The catch of haddock increased 16,044,644 pounds, or 24.06 per cent, in quantity, but decreased $405,338, or 12.66 per cent, in value, while the yield of halibut increased 333,657 pounds, or 18.73 per cent, in quantity and $84,911, or 28.09 per cent, in value. The production of cod decreased 6,450,007 pounds, or 8.98 per cent, in quantity and $1,034,024, or 28.58 per cent, in value; hake, 941,353 pounds, or 17.82 per cent, in quantity and $92,032, or 33.70 per cent, in value; pollock, 7,808,653 pounds, or 29.39 per cent, in quantity and $581,570, or 60.44 per cent, in value; cusk, 595,062 pounds, or 22.38 per cent, in quantity and $40,862, or 39.65 per cent, in value; mackerel, 4,445,271 pounds, or 43.75 per cent, in quantity and $641,682, or 53.97 per cent, in value; herring, 4,637,077 pounds, or 30.92 per cent, in quantity and $220,894, or 47.94 per cent, in value; swordfish, 151,364 pounds, or 14.63 per cent, in quantity and $10,824, or 4.84 per cent, in value; tilefish, 265,910 pounds, or 88.80 per cent, in quantity and $18,772, or 92.71 per cent, in value; and the various other species combined, 103,487 pounds, or 2.44 per cent, in quantity and $22,078, or 12.16 per cent, in value. The catch of Newfoundland herring decreased 2,885,047 pounds, or 45.17 per cent, in quantity and $142,090, or 42.81 per cent, in value. The quantity of tilefish landed at Boston was very small, amounting to only 33,510 pounds, valued at $1,474, as compared with 299,420 pounds, valued at $20,246, the previous year.

The products landed at Boston and Gloucester, Mass., and Portland, Me., by fishing vessels each year are taken principally from fishing grounds lying off the coast of the United States. In the calendar year 1919, 71.72 per cent of the quantity and 70.64 per cent of the value of the catch discharged at these ports by American and Canadian fishing vessels were taken from these grounds; 2.93 per cent of the quantity and 4.61 per cent of the value, consisting largely of herring, were taken from grounds off the coast of Newfoundland; and 25.33 per cent of the quantity and 24.74 per cent of the value from grounds off the Canadian Provinces. Newfoundland herring constituted 1.78 per cent of the quantity and 2.51 per cent of the value of the products brought in during the year. The herring were taken on the treaty coast of Newfoundland, and the cod, haddock, hake, halibut, and other species from that region were obtained from fishing banks on the high seas. All fish caught by American fishing vessels off the coast of the Canadian Provinces were from offshore fishing grounds.

Supremacy in the New England fisheries is usually assumed by the cod, with the haddock ranking second. In 1919, however, the haddock took first place, with 82,716,185 pounds, valued at $2,793,938. The yield of cod was 65,374,420 pounds, valued at $2,583,181. The next most important of the ground fish is the halibut, of which 2,114,661 pounds, valued at $387,191, were taken. Pollock showed a marked decrease from 1918; only 18,751,967 pounds, valued at $380,515, were secured, as against 26,560,620 pounds, worth $962,085, in the previous year. A noteworthy advance in production, indicating a growing demand, was in the catch of flounders, the increase over the previous year being over 77 per cent in quantity and 108 per cent in value. The total catch of mackerel was 53,992 barrels, a decline of more than 15,000 barrels from 1918. The catch of salt mackerel was only 7,000 barrels compared with over 13,000 barrels the year before. The total quantity of mackerel landed at the three ports was 5,713,196 pounds, valued at $547,242, of which 4,314,770 pounds, worth $427,104, were fresh. Both purse-seine and gill-net vessels in the southern mackerel fishery in 1920 had one of the best seasons on record. The fish caught weighed from 1½ to 3½ pounds, averaging about 2 pounds, and sold from 8 to 22 cents per pound, according to market conditions. In May there was a large body of mackerel off South Shoal Lightship, and the receipts at Boston landed by vessels were larger than for the same month in any recent year. The catch on the Cape Shore was disappointing; the weather was foggy, and the fish were well offshore, wild, and hard to catch. The total yield of mackerel up to July 1 was 60,842 barrels fresh and 3,357 barrels salted, compared with 38,787 barrels fresh and 6,452 barrels salted the previous year.

VESSEL FISHERIES OF SEATTLE.

The fishing fleet at Seattle, Wash., landed 670 trips during the year 1919, consisting of 13,651,020 pounds of fresh fish, having a value to the fishermen of $1,530,284, from fishing grounds along the coast from Oregon to Alaska. The largest quantities were taken from Grays Harbor grounds, Flattery Banks, west coast of Vancouver Island, Hecate Strait, and Yakutat grounds. The products included halibut, 11,110,720 pounds, valued at $1,422,519; sablefish, 1,553,600 pounds, valued at $74,290; "lingcod," 723,000 pounds, valued at $24,433; and rockfishes, 263,700 pounds, valued at $9,042. Compared with the previous year there was a decrease of 164 trips by fishing vessels, and of 20.13 per cent in the quantity and 18.93 per cent in the value of the products. The catch of halibut increased 8.46 per cent in quantity, but decreased 6.95 per cent in value. There was a large falling off in the catch of sablefish, "lingcod," and rockfishes, owing chiefly to a smaller demand than in the previous year.

The fishery products taken in Puget Sound and tributary waters and landed by collecting vessels during the year amounted to 11,809,450 pounds, valued at $983,819. This quantity included 10,387,703 pounds of salmon, valued at $902,717, and the remainder consisted of steelhead, pilchard, smelt, rockfishes, cod, flounders, crabs, and other species. Compared with the previous year, there was an increase in the products landed by collecting vessels of 11.35 per cent in quantity and 7.80 per cent in value.

SHAD FISHERY OF THE HUDSON RIVER.

According to a special canvass conducted by the Bureau, considerable improvement in the shad fishery of the Hudson River in 1919 is to be reported. The number of fish taken in recent years was as follows: 1915—15,855, value $8,643; 1916—9,287, value $5,465; 1917—12,015, value $6,540; 1918—67,403, value $48,184; and 1919—90,301, value $83,724. In 1919 there were 299 men engaged in the fishery, employing 158 boats representing a value of $6,700; 373 gill nets with a value of $15,269; 12 seines, valued at $1,700, and shore and accessory property valued at $7,920; a total investment of $31,589. The catch of 90,301 fish weighed 374,974 pounds, of which 76,501 shad or 301,306 pounds, valued at $60,690, were taken on the New York side of the river and 13,800 fish or 73,668 pounds, valued at $23,034, on the New Jersey side.

The Bureau plans to continue taking a yearly canvass of this fishery of the Hudson River where, in the absence of fish-cultural operations, dependence for the rehabilitation of the fishery rests on natural production and local protective measures.

SHAD AND ALEWIFE FISHERIES OF THE POTOMAC RIVER.

The Bureau has undertaken a yearly canvass of the shad fishery and the closely associated alewife or river-herring fishery of the Potomac River, a river in which extensive shad-cultural operations are being conducted. In 1919 the number of persons engaged was 789, employing 514 boats, valued at $80,685; using 306 pound nets, valued at $159,810; and 267 gill nets and one haul seine, valued at $26,761. The shore and accessory property was valued at $610, and the total investment was $267,866. The number of shad taken was 544,469, or 2,040,473 pounds, valued at $332,397. The number of alewives taken was 8,867,902, or 3,676,921 pounds, valued at $61,016.

The number and value of shad taken in this river for various years from 1896 to 1919 was as follows: 1896—684,063, $63,608; 1901—794,462, $119,366; 1904—372,647, $68,052; 1909—203,971, $53,732; 1915—182,402, $72,127; and 1919—544,469, $332,397. The added protection afforded these fish in recent years by restricting the distance from shore at which the fixed nets may be set, supplemented by active operations of the hatchery at Bryans Point, Md., has apparently been of direct benefit to the fishery, which is very intense, owing to the prevailing high prices.

FISHERIES OF THE GREAT LAKES STATES.

The Bureau's complete statistical canvass of the commercial fisheries of the Great Lakes during 1917 was duly finished, and the results were published in a form to show the fisheries by lakes. A regrouping of the figures has been made so as to set forth the fisheries by States.

The number of persons ascertained to be engaged in the fisheries of the Great Lakes was 9,221, of whom 3,183 are credited to Michigan, 1,909 to Wisconsin, 1,761 to Ohio, 683 to New York, 608 to Minnesota, 564 to Illinois, 446 to Pennsylvania, and 67 to Indiana. The investment in the fisheries in the different States arranged in order of importance was as follows: Michigan, $2,937,086; Ohio, $2,462,832; Wisconsin, $1,668,529; Illinois, $1,265,664; Pennsylvania, $919,919; New York, $793,371; Minnesota, $428,443; and Indiana, $79,825; total, $10,555,669. Arranged in the order of the value of the products, the States ranked as follows: Michigan, 29,737,355 pounds, valued at $2,035,889; Ohio, 26,442,993 pounds, valued at $1,570,230; Wisconsin, 24,042,103 pounds, valued at $1,320,162; Pennsylvania, 8,151,241 pounds, valued at $508,382; Minnesota, 10,041,846 pounds, valued at $429,667; New York, 3,481,236 pounds, valued at $268,215; Illinois, 1,356,294 pounds, valued at $87,375; and Indiana, 1,016,155 pounds, valued at $75,099; total output, 103,759,223 pounds, valued at $6,297,969.

Detailed tables and discussions of the fisheries of the Great Lakes and certain tributary waters and of Lake of the Woods and Rainy Lake are included in the report of the division of fishery industries for 1919.

FISHERIES OF THE GULF STATES.

A canvass of the coastal fisheries of western Florida, Alabama, Mississippi, Louisiana, and Texas for the calendar year 1918 was completed during the past fiscal year, and the detailed tables and discussions have been included in the divisional report.

In 1918 these fisheries gave employment to 14,888 persons, the total amount of capital invested was $6,537,859, and the products aggregated 130,923,583 pounds, valued at $6,510,310. Some of the more important products taken were mullet, including roe, 28,641,364 pounds, valued at $1,318,379; oysters, 23,754,465 pounds, or 3,393,495 bushels, valued at $1,106,725; shrimp, green and dried, 27,142,999 pounds, valued at $1,098,427; sponges, 452,188 pounds, valued at $725,155; red snapper, 9,429,802 pounds, valued at $609,312; squeteagues or "sea trout," 4,960,738 pounds, valued at $414,593; Spanish mackerel, 3,494,845 pounds, valued at $251,197; groupers, 5,935,825 pounds, valued at $235,406; redfish or red drum, 2,986,180 pounds, valued at $175,109; and menhaden 14,413,942 pounds, valued at $110,608.

Compared with the Bureau's returns for this region for 1902, there has been a decrease of 17.42 per cent in the number of persons employed, but an increase of 38.88 per cent in the investment, an increase of 15.15 per cent in the quantity of products, and an increase of 86.31 per cent in the value of the fisheries. Compared with the returns published by the Bureau of the Census for 1908, the increase in the catch amounted to 10.69 per cent in quantity and 33.95 per cent in value.

Partly at least as a result of the Bureau's efforts to extend the use of fishery products in the Gulf region, particularly neglected fishes or by-products, an increase in the catch and uses of such products is to be noted. For example, the yield of black drum in 1890 amounted to 136,053 pounds and in 1918 to 2,011,288 pounds; of groupers in 1890 to 427,781 pounds and in 1918 to 5,935,825 pounds; and of Spanish mackerel in 1890 to 700,459 pounds and in 1918 to 3,494,845 pounds. The yield of the by-products of the fisheries amounted to 17,409,496 pounds, valued at $310,682. This included more than 1,600 tons of fish scrap with a value of $119,384; over 109,000 gallons of oil, valued at $106,618; more than 6,000 tons of ground oyster shells for poultry grit, with a value of $61,177, and several items of minor importance.

The quantities and values of the products by States were as follows: West coast of Florida, 54,753,639 pounds, valued at $3,420,363; Alabama, 5,609,219 pounds, valued at $230,567; Mississippi, 20,592,089 pounds, valued at $762,770; Louisiana, 24,953,876 pounds, valued at $1,419,367; and Texas, 25,014,760 pounds, valued at $677,243.

FLORIDA SPONGE FISHERY.

The Bureau has continued to maintain in Florida a sponge-inspection service to give effect to the law regulating the size of commercial sponges from local waters that may be landed at American ports.

The Florida sponge fishery appears to be in a state of equilibrium between the natural supply and the catch, and if it can be so maintained no concern need be felt for the future. There is perhaps some surreptitious traffic in sponges of less than the legal minimum diameter of 5 inches, but the open and flagrant sale of such sponges which occurred some years ago has been suppressed. The cargoes of sponges on sale at the sponge exchanges sometimes contain a large proportion of sponges barely meeting legal requirements, and a number of persons engaged in the business express themselves in favor of an increase of the legal minimum to 5½ or even 6 inches. The superabundance of small sponges is attributed to the gradually returning productiveness of the beds in comparatively shallow water which were depleted by the spongers a number of years ago. There is no doubt that if the small sponges were permitted an additional year's growth these formerly exhausted beds would yield a larger quantity and, owing to the higher value of the larger sizes, a much greater financial return to the spongers.

BIOLOGICAL INVESTIGATIONS.

GENERAL CONDITION OF THE WORK.

In the field occupied by the Bureau's division of inquiry respecting food fishes and the fishing grounds, the fiscal year 1920 was marked by a reduction in activities as a necessary adjustment to the decreased appropriation for such purposes. The general policy adopted was to continue in progress the more important investigations, reducing the number of projects rather than the quality of the work.

During the preceding year several of the chief agencies of the Bureau's scientific activities were in the hands of the Navy Department, so that provision was required neither for the maintenance of certain stations or vessels nor for their normal activities. Just before the beginning of the fiscal year under report, or in the early part of that year, the Navy Department returned to the Bureau the Beaufort (N. C.) laboratory and the steamers *Albatross* and *Fish-Hawk*, and withdrew from the Woods Hole (Mass.) laboratory. It has been endeavored to put these agencies into effective operation again as far as practicable, but, owing to the necessity for extensive repairs to the Beaufort laboratory and its equipment, that station maintained during the fiscal year 1920 a minimum degree of activity.

This branch of the service has labored under the severe handicap of inability to maintain a full working staff. For several years the scientific personnel has been kept fairly complete, partly as a result of the reducing of entrance requirements to the lowest possible limit. and partly in consequence of the appeal of patriotic service during a national emergency. In the past year, however, scientific employees have gradually but steadily drifted out of the service, and qualified candidates for their places have failed to appear. Accordingly, the year closed with 32 per cent of the scientific positions vacant, among them some of high responsibility, and at the present date the number of vacancies has increased to 36 per cent, with other resignations in prospect. Unless radical changes can be promptly made in the salary scale and conditions of service, the efficient accomplishment of one of the Bureau's primary functions must depend upon the possibility of enlisting the services of men of independent means, inspired by patriotic purpose or zeal for the work, a condition which is both repugnant and unpromising.

STUDIES OF SALMONS AND TROUTS.

Notwithstanding the great amount of attention that has been given, over a long series of years, to the biology of the Pacific salmons, much remains to be learned regarding essential features of their life, growth, habits, etc., and the Bureau has continued to have highly qualified assistants devote themselves to these most important fishes. The efficiency of fish-culture operations and the intelligent application of protective measures require a secure foundation of knowledge of the several species at maturity, the life histories, migrations, and conditions favorable for existence. The studies necessary to establish this base of knowledge are highly technical, tedious, and time-consuming; nevertheless, material progress has been made in the interpretation of the age, early history, and possible races of the chinook salmon in the Columbia and Sacramento Rivers. Further consideration has been given to the capture of immature salmon in the open ocean, a commercial practice which threatens the future of the salmon industry, and a conclusive report may be expected shortly. Investigators have made significant studies of salmon in Alaska, the results of which will serve as a guide both in fish-cultural practices and in the administration of the salmon fishery in Alaskan waters.

There have been conducted anatomical studies and experiments with members of the salmon family which have brought to light conditions that bear directly upon the propriety and effect of certain fish-cultural practices, and that with further study and experiments at hatcheries are expected to lead to improvements in the manipulation of brood fish, and thereby promote efficiency and economy in the operation of trout stations.

The Bureau is also endeavoring by a series of studies, unavoidably technical in nature, to clear up the confusion existing as regards the relationships of the several members of the salmon family, a confusion which is not of theoretical interest alone, but which impedes the efficiency of practical work in the distribution of fishes, which should be based upon definite knowledge of the species propagated and distributed and of the natural range of these and related species. It is sometimes difficult to determine the results of the introduction of species of trout in new waters (as, for instance, the many disputes regarding rainbow and steelhead trouts) because definite criteria are wanting to identify the species propagated on different occasions, or the species found to have become established in the planted waters.

STUDIES OF OTHER FISHES.

A similar sort of obscurity with reference to the species of whitefishes and ciscoes, or so-called lake herrings, of the Great Lakes has been attacked, and there was brought to completion during the year the report of a thorough study of the whitefishes and related species in Lake Huron. The investigation will be extended to Lake Michigan in the course of the present year.

The investigations of smelts which have been pursued during a period of years are nearing completion, and the results will afford long-desired information regarding fishes that are esteemed for their value as human food and that are of even greater value as food of the larger food and game fishes.

The investigation of the paddlefish has been continued, but the species still baffles the most careful inquiry into its habits of breeding. The life histories of marine fishes are receiving persistent attention, and it is expected that substantial contributions in this field may be made at an early time.

In response to many inquiries regarding the possibilities for a sardine-packing industry on the northwest coast, the Bureau conducted a further inquiry into the occurrence of pilchards, or sardines, off the coasts of Washington and Oregon. It was ascertained that sardines occur in these waters irregularly, though abundantly at times, but, in view of the uncertainty of the runs, the difficulties of the fishery, and the general situation in the canning industry, the establishment of sardine canneries in the northwestern States at the present time is not recommended.

FISH-CULTURAL EXPERIMENT WORK.

The experimental work in the interest of fish culture, both public and private, which is pursued primarily in connection with the fisheries biological station at Fairport, Iowa, has been continued as far as permitted by the available means and personnel. The investigations of previous years have yielded results which it has been possible to apply in practice at several of the Bureau's fish-cultural stations, and the advantages to accrue from a more aggressive pursuit of fish-cultural experiment work are undoubted. It is therefore to be regretted that provision has not been made for the special personnel without which it is impossible to make adequate progress.

The experiments at Fairport, which relate to the propagation of bass, sunfish, catfish, and buffalofish in ponds, are supplemented by investigations of the plants and lower animals which live in the ponds and contribute directly or indirectly to the food supply of fish and to the yield of fish from the ponds. Results of special interest and value are regularly obtained, and if the observations could be more widely extended the Bureau would rapidly gain in ability to furnish just the sort of helpful information desired by the amateur fish-culturists in all parts of the country who are seeking to improve the conditions of home life on the farm by developing the fishpond as a source of food and a means of recreation.

MOSQUITO CONTROL BY THE USE OF FISH.

Previous reports have stressed the public service rendered by the Bureau in conducting investigations and practical operations in the employment of fish as a means of exterminating mosquito larvæ under conditions where other means of control are either impracticable or unnecessarily expensive. Renewed assurance of the value of this work was gained during the past year when the Bureau of Public Health Service urgently requested this Bureau to detail an assistant for full time in advising with Federal, State, and local health officers in the proper use of fish in the broad antimalaria campaign in the Southern States. There have also been several freely offered expressions of appreciation for the value of this service from State health officials.

The studies of fishes and other aquatic animals in relation to mosquito control have not been restricted to southern waters, but additional experiments have been conducted in Northern States, notably in the Interstate Palisades Park of New York and New Jersey.

STUDY OF FISH DISEASES.

While the Bureau was without a regular fish pathologist during the first half of the fiscal year, the study of the parasites and diseases of fishes was continued during most of that period by the aid of temporary employees. Diseases of fish in the St. Lawrence River and in certain fish hatcheries were investigated, and appropriate remedies were suggested when practicable. Later in the year systematic researches were directed at such special problems as the widely prevalent "white-spot" disease in salmonoid eggs and the mortality of pike-perch eggs which substantially lowers the efficiency of all pike-perch hatching operations.

SHELLFISH INVESTIGATIONS.

Oysters.—The problems of the oyster industry in some sections are critical and have received the fullest possible measure of attention. The problem of first importance is the failure of set during a period of years in Long Island Sound, and this has been attacked by methods of both biology and chemistry (in cooperation with the Bureau of Chemistry.) A foundation of facts is steadily being constructed, and some tentative conclusions as to the causes of trouble and the methods of alleviation are now possible. No claim can, however, be laid to a complete solution of the problem until further observations and experiments have been made. The inquiries have centered principally about Milford, Conn., and Sayville, N. Y.

It seems fairly clear that one of the disturbing factors, and possibly the chief cause of the failure of set, is the extensive pollution of inshore waters by sewage or industrial wastes, and proper attention is therefore being focused upon this aspect of the question.

Oyster studies have also been made in the Chesapeake Bay and in some waters of the State of Virginia. In the vicinity of Norfolk attention has been given to the damages to oysters resulting from the unlawful discharge of oil upon the waters of Hampton Roads. In the York River, Va., the investigation of conditions affecting unfavorably the growth of oysters has been brought to a close.

Fresh-water mussels.—In the propagation of fresh-water mussels the number of glochidia infected upon fish and liberated in the public waters was conspicuously greater than in the preceding year, and the unit cost was correspondingly lower. The results of artificial propagation are detailed elsewhere. In the experiments directed at the rearing of young mussels until they have attained a size (say half an inch in length) permitting of their being handled with convenience and planted deliberately upon suitable bottoms, notable results have been secured during the year. Before the past year a measurable degree of success had been attained with one species of mussel (the Lake Pepin mucket), but during the summer of 1919 two additional species (yellow sand-shell and river mucket) were reared in considerable quantities in small troughs.

At a conference in La Crosse, Wis., in January, 1920, participated in by representatives of the States of Wisconsin and Minnesota and by other interested persons as well as by assistants of the Bureau, consideration was given to the protection of mussel resources, and, acting upon authority provided by recent concurrent legislation in several States, it was determined to close against commercial shelling for a period of five years certain sections of the Mississippi River bordering the two States represented in the conference. The purpose is to allow opportunity for natural recuperation of the beds and to create favorable conditions for the artificial propagation of mussels. The proposed action, when taken, will represent the culmination of several years of earnest effort by various persons and agencies, in which the Bureau of Fisheries has played a leading part, to bring about the effective protection of the valuable mussel resources of the Mississippi Basin. Up to the present time, only four States which control the principal mussel-producing portions of the Mississippi River have enacted appropriate legislation. It is greatly to be desired that other States having jurisdiction over important shell-producing streams will join in this movement before the resources become too seriously depleted.

In the course of the fiscal year there was issued a document describing in detail the commercial fresh-water mussels, the implements and practices of the mussel fishery, and the machinery and methods of manufacture of buttons from the shells. There has also been completed and submitted for publication a general account of the natural history and propagation of the mussels. These papers are issued in response to a general demand for the varied information contained in them, and with a view to disseminating such knowledge of the resources and industries and of the conditions of their perpetuation as will stimulate the adoption of measures and practices whereby unnecessary waste may be avoided and the future as well as the present may be served.

MISCELLANEOUS STUDIES.

Investigation of the reddening of salt fish, which causes large annual losses to fish packers, has been continued and some definite conclusions are now possible. It has been ascertained that the discoloration is due to the growth of at least two organisms, one of which under appropriate conditions is characteristically red and the other pink. The simultaneous growth of these organisms results in the production of various shades of color. The organisms evidently have their origin in the imported sea salt which is so extensively used in the fishing industry. The conditions of growth of the causative agents have been pretty well determined, and experiments are under way to determine the means of eradication.

In response to solicitations from the trade that domestic sources be found for a vegetable gelatin such as is required for the satisfactory packing of certain fish products in cans, the Bureau has conducted an inquiry into the properties of gelatin derived from the seaweeds of the New England coast. A gelatinous extract from the common "Irish moss" of that coast, when properly prepared, was found to meet the requirements. It has been thought advisable to carry the investigation further and to ascertain the possibilities of developing domestic sources for agar-agar and other valuable gelatins of commerce now imported.

SCIENTIFIC WORK OF THE VESSELS.

The steamers *Albatross* and *Fish Hawk*, which had been surrendered to the Navy Department for the period of the war, were returned to service in the interests of the fisheries during the early part of the fiscal year.

For the present it is intended to retain the *Albatross* in the Atlantic, from which she has been absent for a period of more than 30 years. Her work up to the close of the fiscal year consisted in one cruise to the south as far as the Yucatan Channel and another cruise along the northeast coast and into the Gulf of Maine. Oceanographic studies and fishery trials were features of the cruises. The *Albatross* is now better equipped than ever before for practical fishing operations, and it is expected that as soon as the crew is properly trained and a suitable scientific staff can be found the vessel will make even more substantial contributions to the welfare of the fisheries than it has in the past.

The *Fish Hawk* has been engaged in an exploration of Chesapeake Bay to discover and record the seasonal conditions of salinites, temperatures, currents, and ultimate food supply of fishes, and to ascertain within the limits of feasibility all other conditions affecting the migrations and abundance of fish and shellfish. All of these data are essential for the most intelligent conservation and development of the important fisheries of this bay.

THE BIOLOGICAL LABORATORIES.

For the first time since the early part of 1917 the Bureau has had the full possession of all of its laboratories; but, while available for use, it has not been possible to operate all of them actively. The Woods Hole (Mass.) laboratory was rather fully engaged during the summer of 1919 with investigations in progress concerning oysters, the reddening of salt fish, gelatin from seaweed, and the habits, food, and parasites of fishes.

The Beaufort (N. C.) laboratory could not be put in shape for operation until late in the fiscal year, and deficiencies of funds and of personnel have rendered the station relatively inactive.

At the Fairport (Iowa) laboratory, studies of fresh-water mussels and experimental fish culture were pursued, with the use of the limited space afforded in the old temporary laboratory building. During the year, however, the excellent new building, fireproof in construction, pleasing in appearance, and admirable in design, was brought nearly to completion and its occupancy was expected at an early date in the following fiscal year.

Progress in the construction of the Key West (Fla.) biological station consisted principally in the installation of the necessary units of the pumping system and the construction of a concrete tank tower with storage for both fresh and salt waters. The water system is, therefore, complete and ready for use, and this is one of the most essential features of equipment of the station. The available laboratory space and other accommodations which it has been possible to supply from the appropriations hitherto made are inadequate for scientific work in the interest of the fisheries, except such as may be rendered by the permanent staff authorized. The station functioned usefully for a portion of the fiscal year, but since the loss of its scientific staff, about the middle of the year, it has remained idle and in the charge of a single employee as caretaker.

Too cordial an acknowledgment can scarcely be made of the loyal and devoted service of the men who have still remained in the service during these times when the most trying economic conditions have been and are yet bearing heavily upon them. The Bureau expresses also its appreciation of the services of those who have rendered their contribution to the work of the year, and left only under the compelling pressure of circumstances.

PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

SUMMARY OF THE OPERATIONS.

The output of the hatcheries during the fiscal year 1920 fell short of the results in 1919, when a record was established. The aggregate production was 4,770,355,000, of which 3,872,218,000 were fry, 267,388,000 were fingerlings, yearlings, and adults, and 630,749,000 were fertilized and viable eggs. Important species whose output was larger than in the previous year were catfish, buffalofish, whitefish, chinook salmon, chum salmon, steelhead salmon, rainbow trout, blackspotted trout, grayling, crappie, sunfish, and cod. There was a reduction in the output of shad, cisco, pike perch, yellow perch, pollock, and winter flounder. The net decrease in output was about 1,105,000,000, of which about 1,050,000,000 represented the winter flounder.

Untoward conditions that influenced the fish-cultural work were the partial disorganization of the field force, the increased cost of operations with no increase in available funds, and unfavorable weather during the egg-laying periods. A very serious epidemic among brook trout in New England hatcheries materially reduced the output of that species.

Following is a summarized statement by species showing the number of eggs, fry, and adults, yearlings, and fingerlings distributed during the fiscal year 1920:

SUMMARY, BY SPECIES, OF THE DISTRIBUTION OF FISH AND FISH EGGS DURING THE FISCAL YEAR ENDED JUNE 30, 1920.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish			76,286,060	76,286,060
Carp		37,800,000	6,999,310	44,799,310
Buffalofish		174,585,000	2,616,575	177,201,575
Shad		56,558,270		56,558,270
Alewife		115,000		115,000
Whitefish	111,830,000	278,535,000		390,365,000
Cisco	90,200,000	76,005,000		166,205,000
Silver salmon		5,835,700	2,892,050	8,727,750
Chinook salmon	11,267,000	1,265,770	37,505,500	50,038,270
Sockeye salmon	3,000,000	50,950,000	47,857,615	101,807,615
Humpback salmon		307,200		307,200
Chum salmon		7,318,100	5,733,150	13,051,250
Steelhead salmon	891,600	173,200	3,053,235	4,118,035
Atlantic salmon		1,550,000	225	1,550,225
Landlocked salmon	497,105	1,054,525	90,275	1,641,905
Rainbow trout	2,607,600	64,200	4,200,015	6,871,815
Blackspotted trout	722,600	2,021,500	1,315,700	4,059,800
Loch Leven trout			101,965	101,965
Lake trout	2,960,000	29,140,000	800,785	32,900,785
Brook trout	821,400	3,160,285	6,034,270	10,015,955
Grayling		1,165,000		1,165,000
Pike and pickerel			510,350	510,350
Freshwater drum			29,955	29,955
Crappie			35,897,805	35,897,805
Largemouth black bass		586,500	978,465	1,564,965
Smallmouth black bass		171,000	41,375	212,375
Rock bass			61,035	61,035
Warmouth bass			14,650	14,650
Sunfish			30,879,120	30,879,120
Pike perch	89,625,000	154,900,000		244,525,000
Yellow perch		162,590,100	616,050	163,206,150
White perch			1,500	1,500
White bass			46,070	46,070
Striped bass		16,474,000		16,474,000
Cod	160,992,000	489,175,000		650,167,000
Pollock		557,685,000		557,685,000
Haddock	155,335,000	159,953,000		315,288,000
Flounder		1,603,080,000		1,603,080,000
Miscellaneous			2,824,960	2,824,960
Total	630,749,305	3,872,218,350	267,388,065	4,770,355,720

A gratifying feature of the year's distributions was the increased number of fishes planted as fingerlings. The advance over 1919 in this respect exceeded 100,000,000. The most noteworthy factor in this increase was the Pacific salmons, of which over 97,000,000 were carried to the fingerling stages before being liberated as against 78,421,000 in the previous year.

HATCHING STATIONS OPERATED.

During 1920 the Bureau operated about 60 permanent hatcheries, 5 temporary hatcheries, and a large number of field, auxiliary, and collecting stations. No new hatcheries have recently been authorized by Congress, but the Bureau, in order to serve a public demand and meet existing needs, has established auxiliary stations at several points, and in 1920 such auxiliaries were operated at Lewis River, Wash., for chinook and chum salmons; Washougal River, Wash., for steelhead salmon; Paris, Idaho, for whitefish; Bay City, Mich., for pike perch; Willamette River, Oreg., for shad; Weldon, N. C., for striped bass; La Crosse, Wis., for brook trout and pike perch; and Atchafalaya, La., for buffalofish.

In the following list there are shown fish hatcheries, auxiliaries, and rescue stations operated in 1920, arranged alphabetically by States, together with the species handled at each.

MAIN AND AUXILIARY FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1920.

State and locality.	Species handled.
Alaska:	
Afognak	Sockeye salmon.
Yes Bay	Do.
Arkansas: Mammoth Spring	Largemouth and smallmouth black bass, rock bass.
California:	
Baird	Chinook salmon.
Battle Creek	Do.
Mill Creek	Do.
Colorado: Leadville	Blackspotted, rainbow, Loch Leven, brook, and lake trouts.
District of Columbia: Central station	Shad, whitefish, cisco, chinook salmon, pike perch, yellow perch.
Georgia: Cold Springs	Largemouth black bass, crappie, sunfish, catfish.
Idaho: Paris[1]	Whitefish.
Illinois:	
Cairo[2]	Rescued fishes.
Meredosia	Do.
Quincy	Do.
Iowa:	
Fairport	Do.
Manchester	Brook and rainbow trouts, smallmouth black bass, rock bass.
Bellevue	Rescued fishes.
North McGregor	Do.
Kentucky: Louisville	Largemouth black bass, smallmouth black bass, rock bass, sunfish, yellow perch.
Louisiana: Atchafalaya	Buffalofish.
Maine:	
Boothbay Harbor	Haddock, pollock, winter flounder, alewife.
Craig Brook	Atlantic, landlocked, and humpback salmons, brook trout.
Green Lake	Landlocked salmon, brook trout.
Grand Lake Stream	Do.
Maryland: Bryans Point	Shad, yellow perch.
Massachusetts:	
Berkshire	Brook trout.
Gloucester	Cod, haddock, pollock, winter flounder.
Woods Hole	Cod, winter flounder.

[1] Auxiliary of Springville (Utah) hatchery.

[2] Auxiliary of Louisville (Ky.) hatchery.

MAIN AND AUXILIARY FISH-CULTURAL STATIONS OPERATED DURING THE FISCAL YEAR 1920—Continued.

State and locality.	Species handled.
Michigan:	
Northville	Brook and rainbow trouts, landlocked salmon, cisco, smallmouth black bass, sunfish.
Bay City	Pike perch.
Charlevoix	Lake trout, whitefish.
Minnesota:	
Duluth	Lake and brook trouts, whitefish, pike perch.
Homer	Largemouth black bass, pike perch, rescued fishes.
Mississippi:	
Tupelo	Largemouth black bass, crappie, sunfish.
Friars Point	Rescued fishes.
Missouri: Neosho	Largemouth black bass, smallmouth black bass, rock bass, crappie, sunfish, yellow perch, rainbow trout.
Montana:	
Bozeman	Blackspotted, rainbow, and brook trouts, grayling.
Glacier Park	Do.
New Hampshire: Nashua	Brook and rainbow trouts, smallmouth black bass.
New York: Cape Vincent	Brook, lake, and rainbow trouts, whitefish, cisco, yellow perch.
North Carolina:	
Edenton	Shad, largemouth black bass, sunfish.
Weldon	Striped bass.
Ohio:	
Put in Bay	Whitefish, pike perch, yellow perch.
Port Clinton	Carp.
Oregon:	
Clackamas	Chinook, chum, and steelhead salmons, brook, rainbow, and blackspotted trouts.
Applegate	Silver and steelhead salmons.
Rogue River	Chinook and steelhead salmons, rainbow trout.
Upper Clackamas	Chinook and steelhead salmons, brook trout.
Willamette	Shad.
South Carolina: Orangeburg	Largemouth black bass, crappie, sunfish.
South Dakota: Spearfish	Blackspotted, rainbow, brook, and Loch Leven trouts.
Tennessee: Erwin	Largemouth and smallmouth black bass, rock bass, sunfish, carp, brook and rainbow trouts.
Texas: San Marcos	Largemouth black bass, crappie, rock bass, sunfish.
Utah: Springville	Blackspotted, rainbow, and brook trouts.
Vermont:	
St. Johnsbury	Landlocked and steelhead salmons, brook and rainbow trouts, smallmouth black bass, yellow perch, white perch.
Holden	Brook and lake trouts, steelhead salmon.
Swanton	Yellow and pike perches.
Virginia: Wytheville	Largemouth and smallmouth black bass, rock bass, sunfish, crappie, brook and rainbow trouts.
Washington:	
Baker Lake	Sockeye and steelhead salmons.
Birdsview	Humpback, silver, and steelhead salmons, blackspotted and rainbow trouts.
Duckabush	Chum, humpback, silver, and steelhead salmons.
Quilcene	Chum, silver, and steelhead salmons.
Quinault	Chinook, silver, and sockeye salmons.
Sultan	Chinook, silver, and steelhead salmons.
Big White Salmon[1]	Chinook salmon.
Lewis River[1]	Chinook and chum salmons.
Little White Salmon[1]	Chinook, chum, silver, and sockeye salmons.
Washougal River[1]	Steelhead salmon.
West Virginia: White Sulphur Springs.	Smallmouth black bass, rock bass, sunfish, brook and rainbow trouts.
Wisconsin: La Crosse	Brook trout, pike perch, rescued fishes.
Wyoming:	
Saratoga	Blackspotted, rainbow, Loch Leven, and brook trouts.
Yellowstone National Park[2]	Blackspotted trout.

[1] Auxiliary of Clackamas (Oreg.) hatchery.

[2] Auxiliary of Bozeman (Mont.) hatchery.

DISTRIBUTION OF THE OUTPUT.

The output of the Bureau's hatcheries and collecting stations has reached every State, together with Alaska, District of Columbia, and Hawaii. Individual applications, indorsed by Senators and Representatives in Congress, for fish for public and private waters were filled to the number of more than 8,000, in addition to which about 1,000 special plants of fish were made in public waters of the various States on the initiative of the Bureau's local representatives.

In making distribution from the hatcheries and collecting stations the Bureau's cars traveled 91,525 miles, and detached messengers in charge of baggage-car shipments of live fish and fish eggs covered approximately 400,000 miles.

Two new steel railway cars, especially constructed and equipped for the transportation of live fishes, were put in commission during the year. These cars were built by the American Car & Foundry Co., of Wilmington, Del., and cost, including boilers and pumps, $29,416 and $29,733, respectively. In each car is embodied the most approved methods of railway-car construction, and the equipment includes some specially designed aerating apparatus not previously used, which has resulted in a material saving of fuel. The noteworthy economy effected in the distribution of the Bureau's output has been brought about by the increased carrying capacity of the new cars, which amounts to nearly 35 per cent over that of the other cars now in use. Formerly the distribution cars were equipped with an independent steam plant to supply the air needed for the safe conveyance of live fishes. The new cars are provided with an apparatus whereby the necessary air is obtained from the "train line," thus resulting in a material saving of fuel. A further saving in air has been accomplished by discarding the specially made hard-rubber air-liberator holders formerly used, and substituting one-eighth inch galvanized tees. The hard-rubber holders cost about $1 each and were subject to frequent breakage. The tees cost 5 cents each and will wear indefinitely, at the same time adequately meeting all requirements. The size of tubing used in conveying air to the fish has also been reduced from three-eighths to one-fourth inch.

RELATIONS WITH THE STATES.

Closer cooperative relations now exist between the Bureau and the State fishery officials than at any previous time. Each year adds to the number of field stations operated jointly by the Bureau and the States under an arrangement that reduces expense, increases the output, and promotes the efficiency of the work of both parties.

Acknowledgment is made of the valuable assistance rendered to the Bureau by various State fishery authorities during the year. In some instances the material aid proffered by the States has made possible the conduct of extensive fish-cultural enterprises that otherwise would have been greatly curtailed. The ever-increasing cost of labor and materials has taxed the Bureau's appropriations to the limit, but by means of State assistance it has been possible to carry to a successful outcome several important projects.

In only comparatively few cases have the States failed to respond to the Bureau's desire to establish mutually helpful relations. In one instance the Bureau has been constrained to abandon well-matured plans for the extension of fish-cultural operations in behalf of a State because of what appeared to be the intention of the local authorities to set aside the essential provisions of a law that afforded some protection during the spawning season to the fishes in whose artificial propagation and distribution the Bureau was spending many thousands of dollars.

During the year 1920, 24 State fish commissions received from the Bureau assignments of fish and fish eggs aggregating 232,137,000 eggs, 3,016,000 fry, and 660,000 fingerlings. The eggs were mostly of commercial fishes of the Great Lakes and Pacific coast, furnished to State hatcheries for incubation, with the intention of having the resulting young planted by the State officials in suitable local waters. The fingerlings were for the most part fishes secured in rescue operations in the Mississippi Valley. The details of this State cooperative work are as follows:

ALLOTMENT OF FISH AND FISH EGGS TO STATE FISH COMMISSIONS DURING THE FISCAL YEAR 1920.

[All figures are for eggs unless otherwise indicated. Fingerlings are designated *a* and fry *b*.]

State and species.	Number.
Arkansas: Rock bass	[a]3,000
California: Chinook salmon	4,235,000
Idaho:	
Blackspotted trout	25,000
Chinook salmon	30,000
Illinois:	
Black bass	[a]600
Catfish	[a]261,200
Crappie	[a]14,300
Pickerel	[a]270
Yellow perch	[a]450
Sunfish	[a]158,500
Brook trout	[a]500
Rainbow trout	40,000 [a]3,000
Iowa: Rainbow trout	98,400
Maine: Landlocked salmon	417,105
Maryland:	
Pike perch	1,500,000
Rainbow trout	93,000 [a]3,200
Massachusetts: Chinook salmon	[a]7,500
Michigan:	
Lake trout	1,000,000
Whitefish	20,150,000
Lake herring	2,000,000
Landlocked salmon	25,000 [b]16,600
Pike perch	55,125,000
Minnesota:	
Black bass	[a]15,550
Catfish	[a]20,405
Crappie	[a]2,500
Sunfish	[a]9,950
Lake trout	200,000
Steelhead salmon	25,000
Montana:	
Blackspotted trout	247,600
Lake trout	50,000
Rainbow trout	1,540,000
Nevada:	
Brook trout	78,400
Rainbow trout	106,600
New Hampshire:	
Lake trout	25,000
Whitefish	400,000
Pike perch	2,500,000
New Jersey:	
Pike perch	1,000,000
Rainbow trout	22,000
New York:	
Lake herring	87,700,000
Whitefish	2,800,000
Lake trout	1,600,000
Landlocked salmon	30,000
Ohio: Whitefish	50,000,000
Oklahoma: Rainbow trout	[a]4,380
Oregon:	
Blackspotted trout	105,000
Chinook salmon	7,002,000
Rainbow trout	100,000
Sockeye salmon	3,000,000
Steelhead salmon	700,000
South Dakota: Brook trout	[a]2,400
Utah:	
Brook trout	[a]10,000
Rainbow trout	[a]98,000
Vermont:	
Lake trout	25,000 [a]2,000
Landlocked salmon	20,000
Steelhead salmon	25,000
Pike perch	21,000,000
Yellow perch	[b]3,000,000
Washington:	
Blackspotted trout	150,000
Lake trout	25,000
Steelhead salmon	75,000
Wisconsin:	
Black bass	[a]9,550
Catfish	[a]16,750
Crappie	[a]5,000
Sunfish	[a]10,350
Yellow perch	[a]700
Whitefish	13,680,000
Wyoming:	
Blackspotted trout	100,000
Lake trout	20,000
Rainbow trout	48,000
Total	232,137,505 [a]660,055 [b]3,016,600

There appears to be no evidence that the State of Maryland intends to meet the conditions imposed by Congress in the matter of the reopening and operation of the hatchery at the head of Chesapeake Bay, near Havre de Grace. This hatchery was closed by order of the Secretary of Commerce on January 27, 1917. The condemnation and sale of the property should be considered.

In making original plants of nonindigenous fishes in the waters of any State, the general policy and practice of the Bureau are to defer to the recommendations of the State fishery officials. Individual applications are referred to the State commissioners, and no applications are filled without their consent. Being impressed with the importance of safeguarding State waters from the damage that may result from the introduction of unsuitable fishes, the Bureau has, for a number of years, in cooperation with the States concerned, sought to discourage the planting of basses, perches, pikes, and other fishes of known predatory habits in the Pacific States, because of the injury that may be done to the young salmon and trout, which already have enough natural enemies with which to contend. This policy meets with some opposition from sportsmen and from persons who wish to stock private or small public waters with fishes that are different from those occurring locally. It is well known that there exist in the Pacific States numerous waters not inhabited by salmon and trout in which basses and other spiny-rayed fishes would thrive, but it appears unwise to make exceptions, because there is always the possibility of the introduced fishes escaping at times of flood or becoming established by other means in trout or salmon waters. The results that would be liable to follow are such that the Bureau would not wish to share any responsibility therefor, and its proper course undoubtedly is to continue refusing to entertain applications of that character even if State officials should be inclined to yield to strong importunities.

PROPAGATION OF PACIFIC SALMONS.

While the egg collections at the Pacific salmon stations for the year showed a decrease of approximately 7,000,000 as compared with 1919, the net results of the year's work must be regarded as satisfactory. There has been no abatement of the serious handicap imposed on this work by the excessive cost of materials and the scarcity and cost of labor. Increased appreciation of the Bureau's work by the extensive commercial interests in the salmon fishery is indicated by their requests for its further extension and by the cooperative assistance they have rendered.

At the Afognak station the spawning season of the sockeye salmon began July 26, and by August 22 eggs to the number of 73,133,000 had been laid down in the hatchery, filling all available space. A further collection of approximately 6,000,000 eggs was made on September 8, and installed for incubation in boxes of gravel in accordance with the method developed by A. Robertson, at the Harrison Hot Springs hatchery in British Columbia, bringing the total egg collections to 79,178,000.

Unusually favorable conditions prevailed during the spawning season, the Litnik River and its tributaries being at a stage to permit of the easy ascent of fish and at the same time allow the installation of the racks. The winter was also mild, with but little snow, and communication between the station and the village was rendered simple by the absence of ice in the bay and snow on the tramroad. The egg collections exceeded those of the previous year, and it was estimated that the fish taken for artificial propagation did not represent more than 50 per cent of the spawning salmon that entered the lake. After the completion of the egg collections, the racks were removed in order that the remaining fish might have free access to the natural spawning beds, and as late as September 18 green fish in considerable numbers were observed at the mouths of creeks tributary to the lake. The run of salmon in Litnik River has shown a steady increase since the volcanic eruption in 1912, at which time it was practically destroyed.

During October 10,000,000 eyed sockeye eggs were forwarded to Seattle, Wash., arriving there in excellent condition. From that point 7,000,000 were diverted to the Quinault Lake hatchery and 3,000,000 were consigned to the State Fish and Game Commission's hatchery at Bonneville, Oreg. In March a lot of 3,300,000 eggs whose development had been retarded as much as possible was transferred by a steamer of the Pacific American Fisheries Co., to Ikatan, Alaska, in charge of an employee of the Afognak station. The eggs were incubated on trays in one of the buildings belonging to the company, and the resulting fry were liberated in May in tributaries of Ikatan Lake.

The total destruction of the retaining rack at Yes Bay by the heavy drift brought down by the high water of September 17, the sixth day of the spawning season, reduced the collection of sockeye-salmon eggs at that station to the lowest point in its history, only 9,752,000 being secured. After the destruction of the rack, seining in the river was continued up to September 24, but with unsatisfactory results, as with no barrier to stop them the majority of the fish passed upstream. The eggs obtained were of good quality and hatched with a loss of less than 4 per cent. The output of the station, including 8,628,000 fingerling fish carried over from the previous year, amounted to 12,678,000 sockeye-salmon fingerlings, and at the close of the fiscal year 5,355,000 fish were still in the station ponds.

In addition to the fish-cultural operations outlined, a considerable amount of construction and repair work essential to the proper maintenance of the station was undertaken. The importance of these repairs has been apparent for several years, but because of their extensiveness it has not been possible to set aside from the appropriation for salmon propagation a sufficient amount to meet the requirements without curtailing seriously the fish-cultural part of the work. The unsafe condition of the water-supply flume has long been the cause of much worry, and as it appeared to have reached the full limit of endurance at the end of the fiscal year 1919, it was decided to use the regular allotment for installing a pipe line, a right of way having already been surveyed, and thus give the station a water supply for present needs, with ample reserve for future expansion of the hatchery, and at the same time furnish power for a lighting plant. Six thousand feet of woodstave pipe were obtained, and 2,300 feet of trestle for carrying the pipe were constructed. The available funds were not sufficient to carry the work to completion because of the prevailing high prices of all material and labor, but the importance of finishing the project and of making other essential repairs at the earliest possible date is indicated by the collapse during the winter of more than 100 feet of the old flume. Because of the small number of troughs required to accommodate the light collection of eggs, no loss of eggs was occasioned, though the hatchery was without an adequate supply of water for several hours. On account of the decayed condition of floor timbers and foundation posts, a number of hatching troughs were overturned earlier in the season by the support on which they stood breaking through the floor. No loss occurred, but had the hatchery been filled with eggs or fry, as would have been the case in a normal season, either of these incidents could not have failed to result in a large loss of stock. The trestle, constructed primarily to carry the new pipe for water supply, is built to accommodate a tramcar, thus making available for the convenient use of the station a large amount of timber suitable for fuel and also for lumber. Other important work accomplished by the station employees, with material already on hand and without additional expense, was the replacing of 1,600 feet of plank walk about the station grounds, completing new foundation for the superintendent's residence, constructing 1,320 feet of tramway from the hatchery to the boathouse on the lake shore, and equipping it with 12-pound iron rails. This completes the tramway, extending from tidewater to the hatchery, over which all supplies reach the station.

From the stations in the Washington field, not including Quinault, the total output for the year amounted to 29,956,700 eggs, fry, and fingerlings, these figures including 125,000 eyed steelhead-salmon eggs supplied to applicants. While this output was somewhat below the previous season's, the falling off is attributable to a series of untoward circumstances rather than to a decrease in the run of salmon, and a gratifying increase in the yield of sockeye and silver-salmon eggs is to be recorded.

On July 21, 1919, all the buildings and equipment at the Baker Lake station were destroyed by fire. As immediate action was necessary to safeguard the eggs available from the sockeye salmon already entrapped there, funds intended for use in other fields were diverted for this more important purpose. As a consequence operations had to be discontinued for the year at Darrington, Day Creek, and Illabot Creek, at each of which points traps, flumes, and other equipment had suffered damage from floods and ice during the winter, and funds were not available for making repairs.

Low water in Grandy Creek and Skagit River during the spawning season of the humpback and chinook salmons curtailed egg collections for the Birdsview station. The run of humpbacks was light, but chinooks were in evidence in the river, though beyond the reach of traps or seines and unable to attain the spawning grounds in the tributaries. The number of eggs taken was 74,000 of humpbacks and 54,000 of chinooks. Conditions were better during the silver-salmon run, and 2,198,000 eggs were secured. This stock was augmented by the transfer of 2,418,000 eggs from the Baker Lake collections. Steelhead-salmon eggs to the number of 255,000 also were taken at Birdsview.

The largest run of sockeye salmon recorded during the past 10 years occurred at the Baker Lake station. The first fish entered the trap at the lake outlet on July 1, and the run continued until August, during which period 7,800 fish were taken and transferred to the retaining inclosure for ripening. At spawning time 3,835 of the number on hand—about 49 per cent—were females, which yielded 11,150,000 eggs of good quality. Approximately 200 of the female brood fish escaped from the retaining inclosure during a sudden rise in the lake, the racks at either end of the inclosure being somewhat out of repair; material for repairs to these racks was destroyed by the fire already mentioned and could not be replaced in time. A large run of silver salmon also occurred in Baker Lake, but the river stages were low during the early part of the fall, and fish did not ascend to the lake until November, when the heavy rains in progress caused a rise of 12½ feet above normal, overflowing the trap and permitting many of the fish to escape. The total collection of 2,600,000 eggs was transferred to Birdsview immediately after being eyed. The sockeye eggs passed through the incubation period with only nominal losses, and 10,250,000 advanced fry were returned to Baker Lake.

After the fire of July 21, which destroyed the hatchery, mess house, blacksmith shop, oil house, foreman's cottage, and other small buildings, with all tools and hatchery equipment, it required the most energetic efforts on the part of the station personnel to complete arrangements in advance of the spawning season in September for handling the large numbers of eggs it was expected to collect from the brood fish on hand. The task was especially difficult because of the location of the station with regard to transportation facilities, the nearest railroad station being 18 miles distant and accessible only by pack horses. The first eggs were placed in eight troughs constructed from lumber salvaged from the fire. By October 6 a new sawmill was in operation, and 40 new troughs had been constructed from lumber manufactured on the grounds. In equipping the troughs to receive eggs and fry, more than a thousand trays of three-fourths inch strips covered with wire mesh were required. Early in November the special appropriation of $50,000 provided by Congress for the reconstruction of the station became available, when the station force was augmented by the employment of temporary labor. The sawmill machinery was housed by a building 50 by 80 feet, a temporary shelter was erected over the hatching troughs, and the work of cutting timber, clearing the grounds of wreckage from the fire, and operating the sawmill was pushed as rapidly as possible. The sawmill and construction work had to be suspended during the winter, as ice in the lake prevented the movement of logs to the mill, but it was resumed by March 20, and at the close of the fiscal year the lower frame for the new hatching building had been completed. This building is 56 feet wide and 130 feet long, with 12-foot walls. It will contain 150 standard salmon troughs, and with the contemplated tray system it will have a capacity for handling approximately 40,000,000 eggs and fry to the feeding stage.

Although climatic and other conditions were unfavorable at the Duckabush station, the egg collections exceeded those of several years past. The summer run of chum salmon was very good, and 5,450,000 eggs were obtained. The fish were taken in trap and seines at the mouth of the river, and transported by autotruck a distance of 3 miles to the hatchery without washing, this method having proved the most satisfactory in making transfers of green eggs of the chum salmon. The "water-hardening" process is delayed by permitting the eggs to remain unwashed in the milt, and experiments conducted last season indicate that eggs reaching the hatchery within an hour after being taken suffer little loss, while those held for a longer period invariably show a serious mortality. An excellent run of steelhead salmon occurred at this point, but because of high water the egg collections were not large, aggregating only 405,000. Another unfavorable feature was the necessity of transferring male fish from the Quilcene station, as the run in the Duckabush River appeared to be largely made up of females.

At the Quilcene station the numbers of all species of salmon reaching the racks were small, and as a consequence the egg collections were not as large as last season. This section of Hoods Canal is subjected each year to active fishing by purse seines, and the high prices of recent years have been an added incentive to such operations. While the law prohibits the use of seines within a certain specified distance of the mouths of all salmon streams, a large number of spawning fish are taken directly in the mouths of certain streams entering the canal, to the detriment of the Bureau's work and the future supply. The eggs taken at Quilcene station during the year were 2,200,000 chum, 1,130,000 silver, and 460,000 steelhead. In addition, 2,402,000 chum-salmon eggs were transferred from the Brinnon collecting station. At Sultan, where the year's work in fish culture compares favorably with that of other years, there were taken 3,167,000 silver, 185,000 chinook, and 92,000 steelhead eggs. Practically all of the silver salmon were taken during the period between November 1 and December 15, when commercial fishing is restricted at the mouth of the Snohomish River, and but few eggs were secured after the beginning of commercial operations.

The collection of sockeye-salmon eggs at the Quinault station—8,035,000—exceeded the take of the preceding year by over 60 per cent. During October this station was supplied with 7,000,000 sockeye eggs from the Afognak station. This shipment was made with two objects in view, namely, to relieve the crowded condition of the Afognak station, where more eggs had been taken than could be cared for locally, and to maintain the sockeye salmon in Quinault Lake, this lake and Baker Lake being the only places in the United States outside of Alaska where important spawning grounds of the sockeye salmon exist. When the first eggs were taken, on October 28, and up to November 14, spawning operations were rendered difficult by the low water, but on November 15 a rise of more than 13 feet occurred in Quinault Lake, overflowing the racks in all streams and permitting many salmon to escape. Fishing was resumed on November 19 and continued until December 16, when there was a second rise, followed by the escape of many more spawning fish. In connection with the sockeye operations, 750,000 silver-salmon eggs were taken. Notwithstanding that the run of this species appeared to be in excess of last season's run, the egg collection was much smaller, this being one consequence of the prevailing floods. It is a characteristic of the silver salmon to enter spawning streams in the largest numbers in times of high water, and many fish passed the retaining racks while they were submerged. Chinook-salmon eggs to the number of 40,000 were secured. During December the station experienced a period of the coldest weather ever recorded in that region, the thermometer registering for a time just above the zero mark. This occasioned the loss of a number of sockeye-salmon fry in the rearing ponds and necessitated the immediate liberation of others in the lake.

Experiments were conducted to ascertain the value of seal liver as food for young salmon as compared with other foods in general use. At the close of the year there was no appreciable difference in the size or condition of the fish receiving the seal-liver diet, as compared with other lots feeding on pork liver and fresh fish.

The usual work of rescuing salmon and trout fingerlings from pools that become dry during the summer was taken up in July and August, and upward of 10,000 fingerlings of the silver salmon and blackspotted trout were taken and returned to deep waters. At the close of the fiscal year there remained on hand at the station 1,500,000 sockeye fingerlings.

An outstanding feature of the salmon work in the Oregon field was the successful rearing of an increased number of chinook salmon to the fingerling stage. The output of chinook fingerlings from the Columbia River stations, including 75,000 retained at the end of the year for marking, exceeded 29,000,000, all of them being of Nos. 2, 2½, and 3 fingerling size. Another interesting point in connection with this work was the very satisfactory outcome of experiments in the use of frozen salmon eggs for fish food. Approximately 13,000 pounds of the immature spawn of salmon taken by commercial fishermen were purchased from local canneries at 5 cents per pound and held in cold storage at Portland for use as needed. In preparing it for feeding to the young salmon, the frost was extracted by submerging it in cold water for a few hours, after which it was cooked in a double boiler for two and one-half hours, being stirred at frequent intervals while cooking. Salmon fry receiving a regular diet of this material, with an occasional meal of beef spleen, made more rapid growth, were more vigorous, and suffered less mortality than any lot of fish previously reared in this region. The cost of the eggs is more than that of salted flesh of the spawned-out salmon, which has been used so extensively at all of the Pacific coast stations, but its demonstrated superiority as a food for young fish would seem to warrant its purchase in larger quantities during the year 1921.

Notwithstanding that the very active commercial fishery conducted in the Columbia River each year was augmented last season by an increased number of drift-net and trap-net fishermen, chinook-salmon eggs in excess of 20,000,000 were taken at the Little White Salmon station, the spawning season being from September 19 to October 15. The operations were not altogether favorable, as both the Columbia and Little White Salmon Rivers were at low stage throughout the period the fish were running. The chum and silver salmons, until recently practically ignored by Columbia River fishermen, were sought during the past season as eagerly as the chinook. Collections of eggs of these species amounted to 204,000 chum and 27,000 silver. Transfers of eyed chinook eggs were made to provide room for the feeding of fry and also for the purpose of improving the run of the species at other points. The Clackamas station received 2,110,000, Upper Clackamas 800,000, and the State hatchery at Bonneville 4,000,000. With the exception of 750,000 advanced fry which were retained in the wide water above the rack, all the fish resulting from the eggs remaining at the station were reared to fingerling sizes Nos. 2 and 3, and more than 11,250,000 were returned to the river.

The operations at the Big White Salmon proved successful in every respect, 16,000,000 chinook-salmon eggs being collected during the spawning season, as against 10,665,000 last year. Nearly half of the eggs collected were obtained from fish taken in Spring Creek, thus seemingly furnishing direct evidence of the efficacy of the hatchery and in support of the "parent-stream" theory, as the natural conditions that existed at the mouth of this stream prior to the Bureau's work were such as to preclude the ascent of salmon; the fishway provided to make this stream accessible to the fish proved satisfactory in all respects. Fish entered the stream in such large numbers that at one time it was feared the natural flow of water would be insufficient to hold them without loss. To guard against this, a flume of temporary construction was laid along the bank, with spillways at frequent intervals to insure more thorough aeration of the water. The advantages gained from this work are that Spring Creek is adjacent to the hatchery, and eggs taken therefrom are of a much better quality than those secured from the Big White Salmon River. Eggs from Spring Creek are in the hatching baskets before hardening has taken place, whereas several hours must elapse before eggs taken from the river reach the hatchery. It is frequently necessary to transport the eggs by boat in the rough water of the Columbia, which has a tendency to increase the loss. Of the eggs collected 3,000,000 were shipped in the eyed stage to other stations, and from the remainder 11,600,700 large vigorous fish were liberated in the Columbia River tributaries. The loss on eggs and fish throughout the season was very light.

The usual preparations were made for the collection of chinook-salmon eggs at the Rogue River station, the only modification of the work being the installation of the head rack early in April. By this means some of the early-run fish were stopped. The slight increase in the egg collections from the river may be attributed to this cause, as very few fish are able to reach the upper portions of the stream after commercial fishing begins on April 15. It is expected that favorable action will be taken by the next legislature on a bill to shorten the fishing season, and it is believed that the results of this action and of the new fishway in the Ament dam will be manifested in an increasing number of eggs taken another season. Chinook-salmon eggs to the number of 1,362,000 were collected; these, with 1,020,000 received from the State hatchery, were successfully hatched, resulting in an output of 2,306,700 No. 2 fingerlings.

At the Applegate Creek station the destruction by flood, during the winter of 1918–19, of the irrigation dam by means of which the station secured its collection of eggs necessitated new construction. As the principal egg collections occur during winter, frequently when the river is at flood stage, it was necessary to construct a barrier of a permanent nature, and a fin rack anchored to cement piers, with traps at the shore line, was thrown across the stream. The structure has operated successfully and withstood the floods of last winter without damage. In undertaking this work it was necessary to wait for low water, which occurred during October and November. It was impossible to complete the structure in time to stop the run of silver salmon, which was light, and lasted but two days. As at the Rogue River station, low water prevented the main body of the fish from reaching the spawning grounds, and the collection of steelhead-salmon eggs was reduced fully 50 per cent from this cause. The season's take was 2,086,000 steelhead eggs, of which 600,000 were forwarded to the Rogue River station and 700,000 to the State hatchery at Butte Falls. The remainder were hatched and the resulting fry liberated in Applegate Creek and other near-by tributaries of the Rogue River.

Acknowledgment is made of the cordial assistance received from the Oregon Fish and Game Commission and the local cannery interests. Without their cooperation the extensive feeding of salmon which was conducted in the Oregon field would not have been possible.

The drought, adversely affecting fish-cultural work in southern Oregon, extended to California, the past winter being unusually mild and almost without rain. The reduced egg collections in California are attributed partly to that cause. The racks installed in the McCloud River during the latter part of the fiscal year 1919 resulted in the collection of 1,350,000 eggs of the spring-run chinook salmon. These were incubated without undue loss, and the fry were reared to fingerlings. During the incubation period the gravity flume was without water, and the hatchery was supplied by pumping from the McCloud River. The racks were removed after the spring run of fish was over, as the fall run of fish at this point has never been sufficiently large to warrant the expense involved in taking eggs. The racks have again been installed for the 1920 season for the spring run of salmon, but the indications are that the effort will meet with failure. The conditions existing at the irrigation dam at Redding have not been remedied, and this, in connection with the protracted drought, has prevented salmon from ascending the Sacramento River. Notice was served on the responsible persons by the California Fish and Game Commission to construct a fishway in accordance with the laws of the State, and plans of a suitable structure were furnished, but this notice was ignored. The matter is now in the hands of the legal authorities, who should take prompt action to compel compliance with the law.

At Battle Creek the collections totaled 4,078,000 eggs, as against 5,384,000 the preceding year. The usual shipments were made to the State hatchery at Sisson, and from those kept at the station 3,619,000 No. 1½ fingerlings were produced. Some further work was performed on the pond system established last season, and the pipe line and supply ditch were completed. The decrease in the number of eggs collected at the Mill Creek station is larger than at Battle Creek, 6,358,000 being the total for 1920, while 17,284,500 were secured last season. Shipments to the number of 4,000,000 were transferred to the Sisson State hatchery in the eyed stage, and 2,122,000 fingerlings were produced from the remainder.

The stack-tray system of handling eggs and fry was tried at stations in this field, with as satisfactory results as have been derived from that form of apparatus at other salmon stations.

PROPAGATION OF COMMERCIAL FISHES OF THE GREAT LAKES.

Climatic conditions during the spawning seasons of the principal fishes of the Great Lakes were extremely variable and on the whole very unfavorable in 1920. The lakes in fall, early winter, and spring are subject to severe storms and sudden variation in temperature. It is at the spawning season that the commercial fishermen obtain their principal catch, and the Bureau is dependent almost entirely on the results of their efforts for its supply of eggs for artificial propagation. It follows that the outcome of any season's work depends largely upon the extent to which the fishermen are able to ply their trade. There are, of course, other factors that make for the success or failure of the work, but the weather conditions are the governing factor.

Collections of whitefish eggs were made in each of the five Great Lakes, and there were taken 420,425,000 eggs against 550,868,000 for last season, the largest numbers, as usual, from Lake Erie. The decrease was not ascribable to any falling off in the number of fish on the spawning grounds. On the contrary, there was an excellent run of fish, fully equaling, if not exceeding, that of last season. The outcome was due entirely to unfavorable weather that prevailed throughout the egg-collecting period.

The field work in Lake Erie yielded 317,360,000 whitefish eggs, the most productive points being Port Clinton, Middle Bass Island, Put in Bay, Monroe, and Isle St. George. While the collections were 25 per cent less than in the previous year, the eggs were of excellent quality and the percentage of healthy fry was the highest ever attained at the Put in Bay station. Transfers of eggs were made to the Ohio, Michigan, and Minnesota fish commissions and to the Bureau's hatcheries at Duluth and Charlevoix. The eggs that were retained produced 200,000,000 fry, which were planted in local waters. The mean incubation period was 133½ days, 10 days longer than in the previous season, with the mean water temperature 2° F. lower.

Acceding to the urgent requests of persons interested in the commercial fishery for carp in tributaries of Lake Erie, the artificial propagation of this species was resumed in the spring of 1920. A battery was set up at Port Clinton and the same methods of manipulation that proved successful last season were employed. The results were satisfactory, 47,250,000 eggs being obtained from fish taken in seines by the commercial fishermen and 37,800,000 fry produced and liberated. The first eggs were taken on June 2 and hatched on the fifth day after being placed in the jars, the eye spots appearing on the third day. Eggs taken later in the season eyed on the second day and hatched on the third, in a mean temperature of 74½° F. The collections of last season amounted to 28,500,000 eggs. The local fishing interests are in the heartiest accord with this work and have rendered valuable assistance by furnishing a building, men, and equipment.

The collection of whitefish eggs was undertaken for the Charlevoix hatchery at the usual points in Lakes Michigan and Huron. Rough weather so interfered with fishing operations that the take of eggs was reduced to approximately one-half of last season's, only 17,680,000 being obtained, but all were of unusually high quality and produced healthy fry. Because of the widely separated points at which the whitefish fishery is conducted, the establishment of a field station, provided with suitable crates for holding the fish for ripening, located at some central point on the north shore of Lake Michigan, should be considered.

Just prior to the whitefish spawning season on Lake Ontario arrangements were made with the Dominion and Ontario provincial fishery authorities for the cooperative collection of eggs in the Canadian waters of Lake Ontario. Under this arrangement it was agreed that the first 30,000,000 eggs obtained by American spawn takers in Canadian waters should be delivered to the provincial hatcheries, but that all collections in excess of that number were to be sent to the Cape Vincent station. It later developed that the provincial hatchery required only 21,800,000 eggs, and that was the actual number furnished. The plans outlined early in the season provided for collecting stations at Deseronto, Bygotts Point, and along the shore near South Bay, Ontario. A severe storm during the first week of operations precluded any collections, and when the weather improved the season was well advanced. At this time the market price of whitefish dropped to 6 cents per pound, which resulted in the practical abandonment of the fishery at Deseronto. Still another incident that had the effect of further handicapping the fish-cultural work at this point was the opposition by fishermen to the recent action of Dominion and provincial fishery authorities in closing certain sections of the upper reaches of the Bay of Quinte to commercial fishing. This feeling was reflected in the failure of many of the fishermen to lend assistance. Only 6,300,000 whitefish eggs were obtained in the Deseronto field, but there is reason to believe that by establishing better relations with the local fishermen, and with favorable weather, this point can be extensively developed as a collecting station. At Bygotts Point and South Bay the fishermen were in hearty accord with the work and rendered valuable assistance. However, the weather was a serious drawback, and egg collections at both points suffered therefrom. At South Bay, for example, the total take of whitefish eggs for the season was 39,805,000, of which number 25,000,000 were taken in two nights of favorable weather. Bygotts Point station yielded 30,560,000 eggs. Each of these fields is comparatively new, being occupied for the second time only, but promises to be very productive when fully developed. On the grounds near Cape Vincent 8,800,000 eggs were secured, bringing the grand total for the season to 83,665,000 eggs. In addition to those turned over to the Province of Ontario, 2,800,000 eggs were shipped to the New York Conservation Commission, 2,500,000 eyed eggs were planted in Lake Ontario, and small lots of eyed eggs to the number of 1,900,000 were shipped to Central Station, the New York Aquarium, and Warren, N. Y. The remainder were retained at the station and the resulting fry returned to the waters of Lake Ontario.

In the lake herring or cisco work on Lake Ontario no new fields were entered in 1920. Collections of eggs from the catches of the fishermen were made at Sodus Point, Fairhaven, and Cape Vincent to the number of 181,150,000. The eggs, which were of remarkably good quality, were disposed of in various ways: Some lots were sent to the Michigan Fish Commission, the New York Aquarium, and Central Station, and 87,700,000 were consigned to the New York Conservation Commission. The remainder, approximately 90,000,000, were retained at the Cape Vincent hatchery and yielded 73,505,000 fry, which were planted in suitable local waters.

The hatching of lake trout in 1920 was on about the same scale as in 1919. During the spawning season in Lake Superior the employees of the Duluth station collected eggs at points on the north shore of the lake and at Isle Royale, Mich. A few eggs of the early run were taken between September 23 and October 20, but the largest collections were secured later. The season closed in the last week of November with a total take of 21,079,000 eggs. The results were disappointing, as from the number of fish on the grounds where commercial fishing is conducted along the north shore there was reason to believe that a very successful season from a fish-cultural standpoint was assured. Because of the destruction of nets by storms, the collections exceeded those of last year by only a small margin. Conditions on the south shore were even more unfavorable, and this field was abandoned shortly after November 1.

For the Michigan stations lake-trout eggs were obtained at the usual points in Lakes Michigan and Huron. A large body of fish appeared during the spawning season, but the fishermen were able to operate their nets only at irregular intervals. A total of 31,733,000 eggs were secured, most of which were of an average quality, though at certain points where only inexperienced help was available the quality was inferior. As indicative of the changing condition of the lake fisheries, it is interesting to note that while for a number of seasons past enough lake-trout eggs were not obtainable to justify the expense of operations at the Alpena hatchery on Lake Huron, more eggs of that species were taken during 1920 in the vicinity of Alpena than at any other point on the lakes. If this situation continues, the advisability of resuming regular operations at this point may be worthy of consideration. Practically all of the lake-trout eggs collected in Michigan waters in recent years have been obtained from the fisheries in the vicinity of Charlevoix and Beaver Island, Lake Michigan.

As in other parts of the Great Lakes region, the work of the Cape Vincent station in Lake Ontario suffered from stormy weather. Lake-trout eggs were sought at Pigeon and Stony Islands, but only a few days were suitable for fishing during the time the fish were on the spawning beds. While the run did not appear to be as large as last season's, the total number of eggs taken from both points—941,000—was more than 200,000 in excess of last year's collection.

The season's pike-perch operations on the Great Lakes and on Lake Champlain were on a much less extensive scale than in 1919. The winter of 1919–20 was severe, and very heavy ice formed on Lake Erie; nevertheless by the end of March the lake was free of ice and the pike-perch fishermen were able to set their nets earlier than usual. During the first days of the season the take of fish was very large, and a successful season in pike-perch hatching was anticipated. There followed a period of cold weather, with snow and heavy winds, that had the effect of destroying many nets and of breaking up the schools of spawning fish. Operations for this species were continued longer than usual in the belief that a change in the weather would bring a return of the fish, but the season closed on May 10 with a total collection of only 116,950,000 eggs. With the exception of 1,000,000 shipped to Central Station, all the eggs were incubated at Put in Bay and the fry liberated in Lake Erie.

The success attending the experiments in connection with the propagation of pike perch in Saginaw Bay last season made it advisable to resume the work this year. Some difficulty was experienced in finding a suitable location for the establishment of a battery where a water supply free from chlorine was available. Such a place was eventually found at Bay City, and a battery of 100 jars was installed. Last season the sterilized water from the city supply proved entirely unsuitable for fish-cultural purposes, and practically all the eggs retained at Bay City were lost from this cause. In the spring of 1920 large numbers of spawning pike perch entered Saginaw Bay, but because of certain difficulties in transportation the express company at Bay City on several occasions placed an embargo on shipments of fresh fish. As suitable storage facilities were not available, the fishermen were forced to suspend operations during the time the embargo was in force. Under these conditions only 95,700,000 eggs were obtained, and because of the intermittent operations they were not of the best quality. Of the number taken, 40,575,000 were placed in the jars at Bay City for incubation, and the remainder were delivered to the Detroit hatchery of the Michigan Fish Commission. The excellent facilities for pike-perch work in Saginaw Bay would seem to justify the establishment of a permanent station equipped to handle the large numbers of eggs that seem to be obtainable under favorable conditions. There is a strong public sentiment in favor of such an establishment.

In continuance of the arrangement made last season for the collecting of pike-perch eggs in Turtle River in cooperation with the Minnesota Game and Fish Department, 32,000,000 eggs were obtained as the Bureau's share and were hatched under the direction of the Duluth station. At the hatchery on Lake Champlain 171,450,000 pike-perch eggs were secured, as against 245,350,000 in 1919. The quality of both eggs and fry was superior in 1920, as a result of improved facilities and methods. Although the eggs were taken during a period of 15 days, yet within 48 hours after hatching began the incubation of all eggs on hand was completed. One-third of the eyed eggs were delivered to the Vermont Department of Fisheries and Game under an agreement whereby a part of the expense of the Swanton hatchery is borne by the State.

In order to meet a demand and also to take advantage of opportunities for increasing the supply of food fishes, the Bureau has continued to hatch yellow perch at Put in Bay, Cape Vincent, and Swanton, the last-named station having the largest output. At that place 30,000,000 eggs were collected, and 27,800,000 fry were hatched therefrom. After a suitable number of fry had been returned to local waters, the remainder were distributed to applicants in New York and New England.

The value of the Bureau's fish-cultural work addressed to the commercial species of the Great Lakes is very generally recognized, and that it should be extended as fully as possible is the opinion of all persons having an interest in the important industry. The Bureau is constantly being urged to undertake the further expansion of its activities, but is prevented from doing so by lack of the necessary funds. There are points in various sections of the Great Lakes region where profitable collecting stations may be developed that will produce many millions of ripe eggs that at present are a total loss because they are sent to market in the fish. There is little reason to doubt that the annual output of whitefish, cisco, lake trout, pike perch, and yellow perch can be very materially increased in all the Great Lakes if sufficient funds for the establishment and operation of new field stations can be obtained.

CULTIVATION OF FISHES OF MINOR INTERIOR WATERS.

The active and increasing demand for fishes for lakes, ponds, and interior streams has in general been met by the various stations devoted to the trouts, landlocked salmon, basses, crappies, sunfishes, etc. As a rule, the applications for such fishes can be promptly filled, but the production of smallmouth black bass has never been equal to the demand, and the regular output of brook trout has had to be supplemented by the purchase of large numbers of eggs from private fish-culturists.

The stations in the Rocky Mountain region in Montana, Wyoming, Utah, Colorado, and South Dakota have handled the native trouts and two introduced trouts, together with grayling, and the season's output was of average volume.

In the Montana field, with the Bozeman station as headquarters and with hatcheries in Yellowstone National Park and Glacier National Park as auxiliaries, the varied operations have been successful. The collections of rainbow-trout eggs in Madison Valley, aggregating 3,812,000, were only a little below the record take of the previous year, and grayling eggs to the number of 700,000 were obtained in the same field.

At the hatchery on Yellowstone Lake, in Yellowstone National Park, some of the eggs of the blackspotted trout taken from wild fish are incubated and the resulting young are deposited in park waters, while limited consignments of eyed eggs are made to the Bozeman hatchery and to the fish commissions of the States of Montana, Wyoming, Idaho, Oregon, and Washington. During the season of 1920, which involves the end of the fiscal year 1920 and the beginning of the fiscal year 1921, about 6,500,000 eggs were taken. In the summer of 1919 the Commissioner made a personal inspection of the fish-cultural work in the park, and made arrangements for extending and augmenting the hatching operations in view of the very heavy drain on the fish life occasioned by the greatly increased number of anglers now resorting to the park. The superintendent of the park has extended every facility for making the hatchery effective and for enabling the Bureau to maintain and improve the supply of fish in the park waters.

The auxiliary hatchery in Glacier National Park, constructed for the National Park Service, but operated by the Bureau of Fisheries, has already justified its establishment. Encouraging reports are being received as to the results of this pioneer work, and it is believed that in a short time noteworthy collections of eggs may be obtainable from waters entirely devoid of fish life previous to the Bureau's entry into this field. The fiscal year's hatching operations in the park extended from July 1 to September 30, 1919, and from April 29 to June 30, 1920. The eggs handled consisted of 300,000 brook trout from the Leadville station, 310,000 rainbow trout from the field station in Madison Valley, 500,000 grayling obtained through the courtesy of the Montana Fish and Game Commission, and 200,000 blackspotted trout from Yellowstone National Park. From these eggs 1,369,000 fry and fingerlings were hatched and planted in selected waters in Glacier Park.

Until funds become available for the development of a number of promising outlying fields, the output of the Saratoga station in Wyoming must be somewhat limited. Brood fish on hand produced during the last fiscal year 96,000 eggs of brook trout and 297,000 eggs of rainbow trout, while collections from wild fish, made under difficult conditions, yielded 31,000 eggs of brook trout and 408,750 eggs of rainbow trout. The hatchery supply was augmented by 430,000 eggs of blackspotted trout and 406,000 eggs of brook trout from other stations.

At the Springville (Utah) hatchery the brook rainbow and blackspotted trout have remained in excellent condition, but the eastern brook trout have deteriorated. Fish Lake continues to be the most prolific source of eggs. The lake is operated jointly by the Bureau and the State game and fish department, and the Bureau's share of the collections in 1920 was 1,035,000 brook-trout eggs and 1,330,000 rainbow-trout eggs. Special attention is being given to the maintenance of the fish supply in Fish Lake, as its value as a source of eggs is recognized.

The work of the Leadville hatchery and its field stations in Colorado was quite successful, especially as regards the propagation of eastern brook trout, of which 5,909,900 eggs were obtained by parties stationed on eight lakes. In an attempt to develop a new field station for collecting eggs of rainbow and blackspotted trouts at Antero Reservoir, two apprentice fish-culturists detailed to make investigations and locate spawning grounds were mysteriously drowned.

Owing to lack of suitable help and to the abnormally large expense that would have been required, no attempt was made at the Spearfish (S. Dak.) station to obtain eggs from wild fish as heretofore. Brood stock held at the hatchery produced 107,000 eggs of eastern brook trout and 130,000 eggs of rainbow trout, which were supplemented by 947,000 eggs of brook trout purchased from dealers and by the transfer from other fields of 419,000 eggs of blackspotted trout and 25,000 eggs of lake trout. The water supply at this station has long been unsatisfactory and at times precarious. During the protracted winter of 1919–20, the flow of water was at one time reduced to 22 gallons per minute for all hatchery purposes, and three 12-foot troughs each containing from 25,000 to 40,000 eyed trout eggs were given only 2½ gallons per minute, which amount was not increased and the numbers of eggs and fry were not reduced until the feeding stage was reached. By an agreement recently made with the municipal authorities of Spearfish, the Bureau is to have the use of the overflow from the newly constructed city reservoir. By means of a separate pipe line, water of desirable quality will become available without cost, and for the first time the hatchery and ponds will have an adequate supply for present and prospective needs.

In the New England trout hatcheries there was a serious epidemic, which greatly curtailed the production of brook trout. At the Berkshire hatchery the malady, known as the "white-spot" disease, was particularly severe and reduced the output to insignificant proportions. Even under favorable conditions the yield of brook trout at the Bureau's hatcheries is unequal to the demand, and resort must be had to private hatcheries for some millions of eyed eggs that are required each season. The price paid for these eggs has risen from 30 to 40 cents per thousand in 1912 to 75 and 80 cents per thousand in 1920, with every indication that it will advance still further. This supply is uncertain and frequently of inferior quality, owing to the fact that many commercial trout breeders engage in the work with the main object of supplying fish for the market, the production of eggs being incidental. In these establishments the fish are put on the market after their first spawning, and it is well known that eggs taken from young fish are never equal in quality to those obtained from 3 to 5 year olds. From every standpoint it is highly desirable that the Bureau should have a source from which brook-trout eggs in sufficient numbers may be obtained to meet all requirements and relieve it of dependence on the high prices and inferior stock of the commercial dealers. After a consideration of this subject, York Pond, in the White Mountain National Forest Reserve, N. H., was selected as a site for the development of a source of supply for brook-trout eggs. A camp was established and preliminary work on the project undertaken during June, 1920, and allotments of fingerling trout were planted in the pond during that month. With the cooperation of the State of New Hampshire by the enactment of legislation giving the Bureau control of the pond, which is approximately 19 acres in area, and of the Forest Service in maintaining roads, it is expected that the full development of this body of water will enable the Bureau to produce large numbers of brook-trout eggs of a high quality and at reasonable cost.

Landlocked-salmon propagation, conducted principally from the station at Green Lake, Me., and its subsidiary at Grand Lake Stream, was rather more successful than in the previous year. The output was 1,641,905 eggs, fry, and fingerlings. Green Lake, one of the sources of eggs, was at an unusually low level, and the fish were unable to ascend the tributary streams for spawning. The eggs secured at this point were from fish caught in pound nets in the lake. Of the eggs distributed 417,105 went to the State of Maine, in fulfillment of the agreement by which the eggs taken by the Bureau on the Fish River Lakes are to be eyed at the Caribou State hatchery, and one-half the net collections become the property of the State. The work in this field suffered from lack of competent employees.

The group of stations at which both salmonoid and pond fishes are handled includes those at Wytheville (Va.), White Sulphur Springs (W. Va.), Erwin (Tenn.), Neosho (Mo.), and Manchester (Iowa), where the output is derivable almost entirely from brood fish maintained from year to year in artificial ponds. The aggregate production of these stations in 1920 was, in round numbers, 3,225,000 brook and rainbow trout and 240,000 bass, while there remained on hand at the close of the year 234,000 fingerlings available for distribution and for increasing the breeding stock. While a number of untoward conditions have tended to curtail the yield of these stations, considerable progress has been made in improving their physical condition and in securing a better quality of brood fish. The output of both brook and rainbow trout at White Sulphur Springs was the largest in the history of the station; the Manchester station largely increased its production of rainbow-trout eggs; and by improved methods of handling the fertility of rainbow-trout eggs at the Neosho station increased 40 per cent.

The 1920 output of smallmouth black bass was slightly less than in 1919. At nearly every station where this species is propagated the same adverse weather conditions prevailed, resulting in a retarded spawning, the loss of many of the eggs in the first spawning, the abandonment of nests by the parent fish, and the killing of eggs in later layings by sudden fluctuations in temperature. The only station at which an increased production of smallmouth black bass occurred is Louisville, which distributed over 100,000 fry and fingerlings, and had its most successful season.

The propagation of largemouth black bass was adversely influenced by the same conditions that affected the smallmouth species, although the aggregate output was larger than in the previous year. Both the Orangeburg (S. C.) and the San Marcos (Tex.) stations had an especially successful season, and the latter had the best year in its history. From Orangeburg the production of largemouth bass was 241,765, notwithstanding a considerable loss of fingerlings from cannibalism, owing to the inability to secure capable assistance in promptly removing the young fish from the ponds containing adults. As an innovation in the distribution of pond fishes, 5,400 sunfish were held through the winter at Orangeburg without undue loss, made an excellent growth, and were planted in spring. In response to the large demand for sunfish in the Southern States, an effort is being made to increase the output of this species as fast as possible. The bluegill—the largest, and in many localities and in many respects the most desirable of the sunfishes—is being substituted as brood stock for the other and smaller species.

In Texas there has been a call for pond fishes in excess of the production of the one station operated in the State. To meet this demand, plans were made to increase the production of fish of the species most called for. With this in view, the lease of a parcel of land, desirable for pond construction and conveniently located for the distribution of the output, was secured from the city of New Braunfels. The lease included a supply of water from the city reservoir. About two years ago, following a period during which the San Marcos station was closed, the Texas Legislature enacted a law giving suitable protection to bass, crappie, and other food and game fishes during their spawning period. The absence of such a law in the State was the important consideration in connection with the closing of the station. By a ruling of the attorney general of the State this law was practically annulled during 1920, and the fishes propagated by the Bureau are again left without adequate protection at a time when such protection is most urgently needed, viz, their period of mating, nesting, egg laying, and guarding the young. Any effort to increase the output of artificially reared fishes under these circumstances seems ill advised.

The value and importance of vegetation in pond culture have long been recognized, and much time and effort have been devoted to the production of luxuriant growths of aquatic plants in fish ponds. The intelligent control of this growth is also of importance, and this can not be successfully accomplished without more exact knowledge of the natural food of young bass and other warm-water species. It is of the utmost importance in connection with the subject to know what plants enter directly into the dietary of the fish or contribute indirectly to the support of the smaller animal forms that furnish food for fish. In order that information might be gained on this subject, which appears to have been generally neglected by fish-culturists, a special assistant was employed to make a study of the conditions as they existed at the Neosho station during the winter of 1919–20. More extensive work along similar lines has been done by the same specialist under the supervision of the division of scientific inquiry, and much information of value and interest to fish culture has been gathered. When this is assembled and made available for practical application to the work of the stations, there is reason to believe that beneficial results will follow. The natural food supply for pond fishes is of particular importance, since it is very difficult to induce these fish to accept the various artificial foods that are taken readily by the trouts and salmons.

The Bureau has continued its experiments looking to the development of a satisfactory food for young salmonoid fish at a reasonable cost for replacing the meat products in general use, the price of which has advanced in proportion with all other commodities. Perhaps the most notable results have been from the use of salmon eggs as food for young salmon. These are the immature eggs taken from salmon secured in commercial fishing operations, and are held in cold storage until needed. Canned seal liver, a by-product of the fur-seal islands, gave satisfactory results at a western station, the test indicating that it compares favorably with pork liver. A product sold under the name of "dried flies," the exact nature of which has not been learned, was obtained from a New York importing firm and tried as a food for trout at a number of stations, with unsatisfactory results in every instance. Fishotein, a slaughterhouse preparation, and clam meal have been used with some success, but neither of these products appears suitable unless employed in conjunction with meat. The results of all experiments thus far made, with the exception of frozen salmon eggs, leave beef heart and beef liver at the top of the list as the most desirable foods for young salmonoid fish. Not only do they produce a more rapid growth, but the mortality is much less. Of these two foods the heart seems more desirable for the early feeding stages, while the liver is better for the more advanced fingerling sizes.

PROPAGATION OF RIVER FISHES OF THE ATLANTIC SEABOARD.

Fishes of the Atlantic coast streams which receive attention at the Bureau's hatcheries are the salmon, the shad, the yellow perch, and the striped bass.

For a long period of years the Bureau has been conducting, at its hatchery at Craig Brook, Me., operations addressed to the Atlantic salmon. The scene of this work is the Penobscot River, which is the only New England stream that now has a run of salmon, and even the Penobscot maintains its salmon in the face of serious physical and other handicaps. It seems to be well established that the perpetuation of the salmon fishery in Maine depends largely, if not chiefly, on artificial propagation. The work, however, meets with scant local support, and the fishermen, who are the principal beneficiaries, show little disposition to cooperate. They have demanded full market price for the brood salmon collected by the Bureau and held for the ripening of their eggs, and, in addition, they have asked for a bonus for delivering the fish in good condition. The cost of the brood salmon some seasons has ranged from $6 to $7 apiece, and other features of the work have also been expensive. The fishermen have of late shown a tendency to ask higher and higher prices for fish and a larger premium for careful handling. A proper spirit of cooperation would seem to impel the fishermen, in their own interests, to supply brood salmon to the hatchery at a nominal price and to waive the charge they have been making for proper handling. The wisdom of continuing this work under existing conditions is questionable.

From the Atlantic salmon obtained during the last fiscal year there remained on hand at the spawning time in October 227 fish, which yielded 797,610 eggs. This number was supplemented by 1,000,000 eggs obtained from the fishery authorities of Canada in exchange for trout eggs. Both of these lots of eggs were incubated with normal loss, and the resulting young, to the number of 1,550,000, were planted in the Penobscot and other important streams of Maine.

Shad hatching has been conducted as usual at the stations on the Potomac River and Albemarle Sound. At both points the work was prosecuted under very trying weather conditions. The spawning season at Bryans Point began April 18 and continued until May 18, during which 42,570,000 eggs were obtained from the fishermen, and 38,161,000 fry of excellent quality were hatched and planted. The run of shad into Chesapeake Bay in the spring of 1920 was said to be the largest in a number of years, and specially good catches were made on both sides of the lower bay, but the number of fish reaching the spawning grounds was limited.

At the Edenton station the first spawning fish were found on April 1, and the season ended on May 12 with a collection of 21,667,000 eggs. The incubation period was marked by sudden and extreme fluctuations in air and water temperatures, and rather heavy losses of eggs and fry resulted. The output of young shad was 16,286,000. The shad catch in the section of Albemarle Sound accessible to the hatchery was the smallest for many years, the effects of the light run being augmented by inclement weather, embargo on express shipments, and low prices, which caused many of the fishermen to withdraw their nets early in the season. The fullest cooperation was accorded by the fishermen to the hatchery, and mainly to this fact must be attributed the degree of success that was attained under most discouraging circumstances.

At the striped-bass hatchery, operated on the Roanoke River in North Carolina as an auxiliary of the Edenton station, the 1920 season was successful. Between May 1 and 15, fish caught for market by the commercial fishermen yielded 19,358,000 eggs, which produced 16,474,000 fry, all of which were planted in local waters.

The Bryans Point hatchery has continued to render efficient service in keeping up the supply of yellow perch in the Potomac River. From March 15 to 24, during which very wintry weather at times prevailed and ice formed about the nets, brood fish to the number of 13,411 were obtained from the fishermen. Spawning occurred from March 25 to April 5, after which the 12,811 adult fish on hand were released. The eggs deposited naturally by the fish while being held in live cars numbered 129,544,000. About 2,500,000 eggs were sent to another station; the remainder produced 119,240,100 fry that were deposited on the local spawning grounds.

The recently established field hatchery on the Atchafalaya River in Louisiana was operated for buffalofish in the spring of 1920, and had its most successful season. The hatchery had been enlarged in anticipation of an increased take of eggs, and additional hatching jars to the number of 260 were installed, making 440 jars in all. The first eggs were secured on February 23 and the last on April 4. The collections from the fishermen's nets aggregated 236,420,000 eggs, or more than 100,000,000 in excess of the previous year's production. The plants numbered 174,585,000.

MARINE FISH HATCHING.

Four species of marine food fishes are hatched at the Bureau's three seaside stations in Maine and Massachusetts, namely, the winter flounder, the cod, the haddock, and the pollock. The extreme severity of the winter interfered with all branches of the work and reduced the egg collections by about 800,000,000.

The winter flounder, which now supports extensive shore fisheries that annually contribute many million pounds of excellent food to the markets of the New England and Middle Atlantic States, is handled at the three hatcheries and is the species produced in largest numbers. At the Boothbay Harbor station 792,853,000 eggs were secured and incubated without undue loss, the fry being deposited in the local bays. At the Gloucester hatchery 155,810,000 eggs were obtained. The season's output for the Woods Hole station was the smallest for five years, owing to weather conditions. In the Waquoit field 611,570,000 eggs were obtained under great difficulty, and 16,616,000 eggs came from Hadley Harbor and Quisset Harbor. Later operations in Narragansett Bay yielded 238,318,000 eggs. The aggregate collections for the Woods Hole station in all fields were 866,504,000 eggs of fair quality. With the exception of 35,000,000 eyed eggs and fry consigned to Jamaica Bay, N. Y., the local waters received the plants of fry. The total deposits of flounder fry from the three hatcheries were 1,603,080,000.

Cod eggs for hatching purposes, obtained from the fishermen's catches in the case of the Gloucester station and from brood fish in the case of the Woods Hole station, numbered 570,740,000 and 223,465,000, respectively, the latter number being produced by 2,825 adult fish held in the cistern under the hatchery. The boats of the Gloucester haddock fishermen, visited by spawn takers from the local hatchery, yielded 303,800,000 eggs during the period from January 14 to April 30. In a similar way, during November, December, and January, 954,800,000 pollock eggs were gathered from fish on their way to market. The quality of the eggs was poor and a rather heavy mortality occurred in hatching; 557,685,000 fry were planted.

The Bureau has taken up in a tentative way the matter of salvaging the enormous numbers of ripe eggs of cod, haddock, and other ground fish that are annually wasted in the New England fisheries. The experiment, first tried in 1919, of placing spawn takers on fishing vessels for the purpose of taking, fertilizing, and planting the eggs contained in fish caught for market, was continued in 1920. Five spawn takers between February 26 and April 26 made 14 trips, 8 on otter-trawl vessels and 6 on trawl-line vessels, and afforded further information as to the feasibility of attempting this work on a sufficiently large scale to make it worth while. Upward of 220,000,000 eggs, about equally divided between cod and haddock, were thus obtained and deposited in the natural spawning grounds, under conditions that closely simulate nature. The experience gained in the two seasons' trials indicates that it is entirely practicable to conduct these operations on a gigantic scale at a comparatively low cost, and it is the belief of the Bureau that it may be desirable to initiate the work in cooperation with the owners, masters, and crews of fishing vessels. The saving of a few hundred millions of eggs might not mean a great deal in view of the magnitude of the fisheries and the extent of natural spawning, but the annual saving of some thousands of millions of eggs might be expected to produce an appreciable effect on the supply of marketable fishes.

RESCUE OF STRANDED FOOD FISHES.

No feature of the Bureau's work in fish conservation has had a more rapid development in recent years than the rescue of fishes from the overflowed lands along the Mississippi River. The fishes that are salvaged comprise practically every useful species of the region. The importance of and necessity for the work arise from the fact that when the floods come many of the fishes are in spawning condition and deposit their eggs far from the river. On the recession of the flood waters the resulting young are left behind and eventually become permanently landlocked. Under such conditions the fish inevitably perish as the cut-off ponds and sloughs gradually become dry during summer or are quickly frozen on the advent of winter. The toll of valuable food fishes that is thus taken is enormous, and the opportunity to prevent a part of the annual waste and add to the food supply is most appealing.

The simplicity of the operations, the low cost, and the certain results of great magnitude are the outstanding features. In 1920, as heretofore, headquarters were established at favorable points in the Mississippi Valley, from which seining crews visited the landlocked waters, removed the fish, and planted them in the open waters of the river. The principal centers of the work were Homer and La Crosse, Wis.; Bellevue and North McGregor, Iowa; Quincy and Cairo, Ill.; Clarksville and Canton, Mo.; and Friars Point, Miss.

During the year ending June 30, 1920, but principally in the summer and early autumn of the calendar year 1919, the aggregate number of fish salvaged was 156,659,500. This output exceeded by about 100,000,000, the record that was established in the previous fiscal year.

From Homer, Minn., the work began on August 1 and continued until cold weather and ice made further operations impracticable. From this point five seining crews were employed throughout the season, collecting 37,073,812 miscellaneous fishes, of which 37,007,590 were returned to the river. The season at La Crosse extended from August 13 to November 8. This field includes the territory extending from Dresbach, Minn., to McDonald Dam, below Lynxville, Wis., and seining crews worked from La Crosse, Genoa, Ferryville, and Lynxville, Wis. The territory about Lynxville is one of the most prolific and is capable of much greater development and productivity whenever funds for the purpose are available.

The crews with headquarters at North McGregor were engaged from August 4 to November 10, operating from North McGregor and Guttenberg. The collections amounted to 27,565,287 fish. This field is also capable of further development, a promising territory existing between Clayton and Dubuque, Iowa. From Guttenberg southward no rescue operations have ever been attempted, and reports from the chief game and fish warden of the State of Iowa indicate that this field contains opportunities for rescue work not excelled at any point on the river.

The station at Bellevue, Iowa, produced 39,549,952 rescued fishes during the season, the work extending from August 11 to November 13. Two crews were employed, one operating from Bellevue, and the other from a houseboat, covering the territory from Dubuque to within 7 miles of Bellevue. Further possibilities for rescue work exist in this vicinity. From Savanna, Ill., and points farther south seining crews could be profitably employed.

The operations on the Ohio River, in the vicinity of Cairo, Ill., reached greater proportions than in any previous year. The number of fish taken was 5,830,410, of which crappie and catfish predominated. There was a noticeable decrease in the number of black bass this season, not only in the Cairo field, but at all other points, the cause being attributed to the low stage of the river during the spawning season of the black bass in May and early June, the rise not occurring until after the fish had spawned.

There was a satisfactory increase in the number of fish taken in the rescue work in the vicinity of Friars Point, Miss., under the supervision of the superintendent of the Tupelo station. The work in that section began July 16 and continued to November 14, during which time 847,328 fish, chiefly buffalo fish, catfish, and sunfish, were taken by the seining crews. Of these, 40,630 were distributed to applicants, while the remainder were returned to their native waters.

The usual operations along the Illinois River, at Meredosia, Ill., were conducted, continuing from July 1 to December 4, and resulted in the conservation of 1,340,427 fish. Similar work tried for the first time at Clarksville and Canton, Mo., and other points of minor importance, under the supervision of the director of the Fairport (Iowa) station, produced 1,552,087 rescued fishes.

It is to be noted that the average cost per thousand fish rescued in 1920 was less than 20 cents; and while in certain fields where the output was not large the cost was somewhat higher, more than 75 per cent of the fish were rescued and returned to their native waters at a cost of only 13 cents per thousand.

A small percentage of basses, catfishes, and other species rescued is used in supplying applicants, most of whom are in the States of the Mississippi Valley. This diverted output serves a very useful purpose but is not so great as to constitute a depletion of the Mississippi. In

1920 the rescued fishes that were not restored to the Mississippi but were sent to other waters numbered 983,784, or less than seven-tenths of 1 per cent of the entire number handled.

This public service in immediate aid of the local States but indirectly of value to the entire country has been voluntarily assumed by the Bureau because there has been a strong local demand for it and because of the conviction that it is vastly more important and productive of direct results than are the combined operations of many fish-cultural stations. The work is receiving the approbation of State fish commissioners, commercial fishermen, and the general public. The possibilities of greatly extending its scope and magnitude are believed to be almost unlimited, and the only obstacle that presents itself is lack of funds. In the estimates of appropriations for the Bureau for the fiscal year 1922, there is provision for a very modest increase in the general funds for fish culture in order that the rescue work, among other branches, may receive fuller consideration. No money appropriated by Congress for any purpose can be relied on to yield more certain and more direct economic results.

ACCLIMATIZATION.

Noteworthy enrichment of the aquatic food resources of various parts of the country has resulted from the acclimatization of desirable animals from other sections. Among the well-known instances of successful acclimatization are the transfer of the Atlantic shad and striped bass to the Pacific coast; the Pacific steelhead salmon to the Great Lakes and to minor lakes in New England and elsewhere; the western rainbow trout, the eastern brook trout, and other trouts to numerous States in which they were not indigenous.

The most recent success of this kind is the case of the Pacific humpback or pink salmon in Maine. Following plants of young salmon in streams in the eastern part of the State, runs of adult fish appeared during a number of years. The fish occurred in greatest abundance in the early autumn of 1919, when there were large runs in Dennys and Pembroke Rivers, and smaller runs in Penobscot, Machias, St. Croix, and Magaguadavic Rivers, the last-named stream being in New Brunswick. Weirs in Passamaquoddy and Cobscook Bays took considerable numbers of the new fish which were disposed of locally or shipped to Boston and New York. Accurate information regarding the amount of the catch was difficult to obtain, as the fishermen were in fear of the local law which prohibits the taking of salmon at the only time when the humpback is available, this law having been enacted with sole reference to the Atlantic salmon; but it is within bounds to state that several thousand adult humpbacks were caught and either shipped to market or consumed locally.

The most interesting feature of this case is that the Bureau's fish-culturists, sent to Dennys and Pembroke Rivers during the period of the migration, took and fertilized 499,300 humpback-salmon eggs that were sent to the Craig Brook hatchery.

From the evidence at hand there seems no reason to doubt that the humpback salmon can maintain itself in certain New England rivers and will prove a valuable addition to the local fish supply. The only condition of success that should be safeguarded is that a proper proportion of the run of adult fish should be allowed to reach the stretches in the lower parts of the streams, where suitable spawning grounds exist. The matter is wholly in the hands of the State authorities and involves the maintenance of adequate fishways over the relatively low dams that cross almost every stream of importance.

The introduction of the eastern brook trout into Colorado and other Western States has been a conspicuous success. The establishment of brook trout, rainbow trout, lake trout, European brown trout, and Loch Leven trout in selected waters of the Yellowstone National Park has been a noteworthy accomplishment, and similar service in the Glacier National Park is now in progress.

One of the best, most adaptable, and most widely transplanted of the native trouts is the rainbow, which now affords excellent fishing in practically every State having waters of suitable temperature. As with the eastern brook trout in Colorado and elsewhere, the acclimatized wild rainbow is now supporting extensive fish-cultural operations in various States. Field stations for the collection of rainbow trout eggs in Montana and Wyoming have proved very productive. Meadow Creek, a tributary of the Madison River in Montana, operated as an adjunct of the Bozeman station, has yielded nearly 4,000,000 rainbow trout eggs of the best quality during each of the last two seasons. Sage Creek, a tributary of the North Platte River in Wyoming, has afforded the Saratoga station excellent opportunities for taking large numbers of eggs, even with the crude equipment that has been available; and the superintendent estimates that with proper appliances this field will yield 10,000,000 eggs annually.

ARTIFICIAL PROPAGATION OF FRESH-WATER MUSSELS.

The usual work in mussel propagation was conducted in the field in suitable sections. as heretofore, under the general direction of the fisheries biological station at Fairport, Iowa. A total of 183,021,720 glochidia in a condition of parasitism on fishes were liberated in public waters as compared with 136,907,365 liberated last year, an increase of 46,114,355.

Infection of rescued fishes in the vicinity of Minneiska, Minn., on the Mississippi River and at various points as far south as Dakota, Minn., was accomplished in cooperation with the rescue work of one of the fish-cultural crews operating under the direction of the Homer, Minn., station. The number of fishes rescued in connection with the propagation of mussels was 907,995, of which 36,442 were adults. Of the total number of fishes rescued, 22,567 were infected with glochidia before being restored to the rivers.

Three species of commercial mussels were propagated, the leading one being *Lampsilis luteola*, commonly known as the Lake Pepin mucket. The infected fish hosts were liberated in the Mississippi River off Fairport, Iowa; in Lake Keokuk, Iowa, and Ill.; in the Mississippi River at New Boston and Oquawka, Ill.; in the Mississippi River at Lake Pepin, Minn. and Wis.; at various points along the Mississippi River, between Minneiska and Dakota, Minn.; in Lake Pokegama, Minn.; and in the White River in the vicinity of Newport, Ark.

Small numbers of mussels reared at the Fairport station were planted in public waters at the following places: Lake Keokuk, Iowa and Ill.; Roanoke River at Salem, Va.; Shenandoah River at Elkton, Va.; and Potomac River at Harpers Ferry, W. Va.

The cost of mussel distribution during the fiscal year 1920 was considerably less than in the previous year, being at the rate of $0.0562 per thousand as compared with $0.0689 per thousand in 1919. The decreased cost was due to the larger output of glochidia, notwithstanding the fact that the cost of labor, equipment, and material was greater than in the preceding year. This computed cost of mussel propagation includes overhead charges and depreciation of buildings, boats, and nets calculated at $0.0198 per thousand.

Fresh-Water Mussel Propagation in 1920, Showing Number of Each Species Planted and Points of Deposit.

Locality.	Mucket.	Lake Pepin mucket.	Pocketbook.	Total.
Lake Pokegama, Minn.		60,694,250		60,694,250
Mississippi River at Lake Pepin		82,044,350		82,044,350
Mississippi River between Minneiska and Dakota, Minn.			11,234,995	11,234,995
Mississippi River at Fairport, Iowa	1,878,100			1,878,100
Mississippi River at New Boston, Ill		5,060,250		5,060,250
Mississippi River at Oquawka, Ill	5,000	795,500		800,500
Mississippi River at Lake Keokuk, Iowa and Ill		19,807,675		19,807,675
White River at Newport, Ark	1,501,600			1,501,600
Total	3,384,700	168,402,025	11,234,995	183,021,720

ALASKA FISHERIES SERVICE.

GENERAL CHARACTER OF WORK.

Enforcement of the fisheries laws and regulations constitutes the chief feature of the Bureau's work in connection with the general fisheries of Alaska. Other important duties include the collection and dissemination of statistical information, the marking of stream mouths, inquiries and investigations as to aquatic resources, the study of conditions with respect to proposed fisheries legislation, the inspection of private salmon hatcheries, and the holding of hearings to determine the advisability of further restrictions upon fishing operations.

Details in respect to the work of this service are published in an annual document issued under the title "Alaska Fisheries and Fur Industries." This comprehensive report will give full details in regard to all important phases of the matter involved.

EXTENT AND CONDITION OF THE FISHERIES.

The salmon fishery of Alaska, which reached such enormous proportions in 1918, showed a marked decline in 1919. So serious was the falling off that a prediction may be freely made that, unless most drastic steps are taken to further curtail operations, the industry may suffer almost irreparable damage and may before many years cease to be of paramount commercial importance. As compared with 1918, there were declines in 1919 of 16 per cent in value and 42 per cent in the catch of salmon.

The remedy lies in more adequate legislation, and there is urgent need for revision of the salmon laws now operative. The laws were good enough when passed 14 years ago, the industry then being comparatively undeveloped, but the laws fail to meet the present situation. Last winter much time and effort were devoted to the drafting of a new fishery bill by a committee representing the Bureau, the Governor of Alaska, and the commercial interests. The bill as drafted was not submitted to Congress for the reason that there were certain fundamental differences of opinion as to several important features. The Governor of Alaska desired that practically all money derived from taxation of the fisheries should revert to Territorial uses not connected with the fisheries. There was disagreement also as to rates of taxation and other features. The difficulty in securing proper legislation for the fisheries of Alaska arises chiefly from the divergent views among different interests and the apparent inability to appreciate the seriousness of the situation. This lack of harmony seems to have impressed Congress, which has for many years refused to pass bills that have received approval of committees. Not only is a new fishery law demanded, but there is grave need for increased appropriations, added personnel, more vessels, more hatcheries to enable the Bureau to do its part in safeguarding the fisheries of Alaska.

General statistics collected by the Bureau show that in the calendar year 1919 the total investment in the Alaska fisheries was $74,181,560, an increase of $430,771 over 1918. The salmon industry absorbed approximately 92 per cent of this amount. Employment was given to 28,534 persons, or 2,679 less than in 1918. The total value of the products in 1919 was $50,282,067, a decrease of $8,872,792 from 1918, or approximately 15 per cent. The reduction in the pack of salmon caused nearly the whole of this decrease.

The salmon-canning industry gave employment to 25,499 persons and produced 4,583,688 cases, valued at $43,265,349. There were 134 canneries in operation. The salmon mild-cure industry gave employment to 133 persons and produced 4,490,600 pounds, valued at $916,800. The fresh-salmon trade employed 34 persons and handled a product of 5,208,327 pounds, valued at $356,688. Other products of the salmon industry were pickled salmon, 1,622,000 pounds, valued at $195,447; frozen salmon, 1,552,480 pounds, valued at $130,355; dry-salted salmon, 212,244 pounds, valued at $17,601; dried and smoked salmon, 415,000 pounds, valued at $43,000; oil, 966 gallons, valued at $966; and fertilizer, 724,000 pounds, valued at $18,680.

The halibut industry produced 7,783,179 pounds of fresh halibut, valued at $880,433; 6,495,372 pounds of frozen halibut, valued at $670,147; and 240 pounds of canned halibut, valued at $25. The herring industry yielded 6,357 cases of one-half pound cans and 95,448 cases of one-pound cans, valued at $40,395 and $811,366, respectively; 7,718,985 pounds of pickled herring, Scotch cure, valued at $451,240; 2,216,120 pounds of pickled herring, Norwegian cure, valued at $147,634; 169,374 gallons of oil, valued at $110,800; and miscellaneous products, valued at $114,735. The cod industry had products valued at $825,990, the chief output being 9,829,343 pounds of dry-salted cod, valued at $773,297. The whaling industry yielded miscellaneous products to the value of $1,027,200. Other fishery outputs were as follows: Clams, $184,363; trout, $13,155; sablefish, $35,485; red rockfish, $1,414; crabs, $160; shrimps, $21,000; and miscellaneous fresh fish, $1,639.

ENFORCEMENT OF FISHERY LAWS.

The patrol for the enforcement of the fishery laws and regulations was actively carried on in the season of 1919 and was renewed for the season of 1920. Six of the patrol vessels were owned by the Bureau, and a like number was chartered. The work was made more effective by the employment of a number of temporary assistants as stream watchmen. Their chief function is to prevent violations of the law by their presence at points where extensive fishing in the streams is more likely to occur. The success of this work has been clearly demonstrated during the current season. Owing to limited appropriations, it has not been possible to carry on this phase of the work to the extent that it is desirable, but more active operations are contemplated another year. It is the purpose to employ a larger number of vessels and increase the number of stream watchmen at the more important fishery centers in all sections of Alaska.

It is hoped that the active cooperation of the Navy Department may be secured through the detail of at least 10 subchasers to be at the disposal of the Bureau of Fisheries for the enforcement of the fishery laws and regulations during the active salmon-fishing season, extending from about the first of June until approximately the end of September. Two subchasers were on duty in southeastern Alaska in the season of 1920. One of these rendered excellent service.

The closing to salmon fishing of practically all of the salmon streams of Alaska, together with certain areas outside their mouths, resulted in requests that the Bureau indicate the closed waters by suitable markers. The erection of markers was accordingly begun in the season of 1919, and the work was carried on more extensively in 1920. It will be continued as rapidly as possible, but several seasons will probably be required to complete the work.

The stealing of salmon that have been caught in traps, which has been referred to locally as piracy, developed to a considerable extent in 1919, and in 1920 was again the source of serious loss and annoyance to cannery operators in southeastern Alaska. Several naval vessels in the district had instructions to aid in suppressing this lawlessness, but it was not entirely stamped out. It would seem that there has been some exaggeration at times of losses thus sustained, and the practice would soon come to an end if purchasers of salmon made certain of the source of fish offered for sale and refused to accept stolen fish. The Bureau's agents have cooperated in efforts to suppress this traffic.

As a result of activities of the Bureau's representatives there were numerous convictions for violation of the fishery laws and regulations.

SCIENTIFIC INVESTIGATION OF THE ALASKA FISHERIES.

In the summer season of 1919 an investigation of the spawning grounds of the Copper River was made by Dr. Henry B. Ward.

who spent about seven weeks studying conditions in that field. His report has been published in "Alaska Fisheries and Fur Industries in 1919." Another investigation was made by Dr. C. H. Gilbert and Mr. Henry O'Malley of fishery conditions in central and western Alaska. With the exception of Chignik, visits were made to all the most important fishing districts. Their report also is incorporated in the general report referred to.

The controversy which arose as a result of salmon-canning operations at the Yukon River led to the Bureau's undertaking in 1920 a special investigation of the whole fishery situation on the Yukon. The work was assigned to Dr. C. H. Gilbert and Mr. Henry O'Malley, who proceeded to the Yukon region early in the season of 1920. The results of the investigation will determine the future course of the Bureau in regulating the salmon fishery in that stream.

FISHERY RESERVATIONS.

In accordance with the regulations issued jointly under the terms of the Executive order of March 3, 1913, two additional permits were issued for fishing operations in the Aleutian Islands Reservation. At the end of the fiscal year 1920 there were 26 such permits in force. Fishery matters in the Afognak Reservation have received proper attention. The usual patrol of the fishing grounds was maintained, and permits were granted to natives to take salmon in the reservation. In order to prevent drain upon the supply of salmon for the Afognak hatchery, Litnik Bay was closed at all times to commercial fishing except for silver salmon, which species runs late in the season. The commercial catch of salmon in the reservation was 113,163, a slight decrease from the previous season.

PRIVATE SALMON HATCHERIES.

The private salmon hatcheries operated in Alaska have been inspected, as required by law. In 1920 only two such hatcheries were in operation. One of these, on Naha Stream, in the fiscal year 1920 liberated 17,070,000 red-salmon fry. The other hatchery, on Hugh Smith Lake, planted 11,357,000 red-salmon fry in the same year. Upon the basis of the output of these hatcheries the operators thereof were entitled under the law to a remission of taxes upon canned salmon at the rate of 40 cents a case to the amount of $11,370.80. The Territorial Fish Commission also did fish-cultural work chiefly at Juneau, where a small hatchery is maintained.

WOOD RIVER SALMON CENSUS.

As the result of an investigation made in 1919, Dr. C. H. Gilbert, a recognized authority on the Pacific salmons, recommended the discontinuance of the counting of red salmon at Wood River, which has been carried on each season from its inception in 1908 through 1919, with the exception of the year 1914. Dr. Gilbert felt that the work could be more advantageously conducted elsewhere in Alaska, preferably at Chignik or at Karluk, where the runs would represent distinct races. The determination of the direct ratio between the catch of salmon and the escapement as tallied in either of these streams would be much more important and conclusive than at Wood River, for the reason that the commercial catch on Bristol Bay below the mouth of Wood River is made up of salmon headed for several streams.

REVISION OF REGULATIONS FOR SALMON FISHERIES.

The need of further restrictions upon salmon-fishing operations generally in Alaska being apparent, two hearings were held at Seattle in November, 1919, for the purpose of eliciting information for use in guiding the Department's action in the matter. Following these hearings an order was promulgated by the Secretary of Commerce under date of December 23, 1919, effective January 1, 1920, which had application to a large portion of all the streams flowing into the Pacific Ocean and Bering Sea between Cape Dixon, in southeast Alaska, and Cape Newenham, Bering Sea. The text of the order is as follows:

Hearings having been given at Seattle, Wash., November 20, 1919, and November 25, 1919, respectively, after due notice in accordance with law, for the purpose of determining the advisability of limiting or prohibiting fishing in certain waters in Alaska, and to amend or modify the order of December 21, 1918, and all persons having had full opportunity to be heard, it is hereby ordered, by virtue of the authority vested in me by section 6 of "An act for the protection and regulation of the fisheries of Alaska," approved June 26, 1906, that until further notice all fishing for salmon, or other fishing in the prosecution of which salmon are taken or injured, in all hereinafter-described waters of Alaska be and is hereby made subject to the following limitations and prohibitions in addition to the general restrictions already applicable by virtue of existing laws and regulations:

1. Waters east of the longitude of Cape Spencer:

(*a*) All fishing is prohibited in all salmon streams and their tributaries and lakes.

(*b*) All fishing, except with purse seines and drift gill nets, is prohibited within 500 yards of the mouths of all salmon streams.

(*c*) All fishing with purse seines and drift gill nets is prohibited within 200 yards of the mouths of all salmon streams, and all fishing with purse seines and drift gill nets as well as with all other apparatus is prohibited within 500 yards of the mouths of Chilkat River, Chilkoot River, Anan Creek, Hetta Creek, Sockeye Creek, and Naha Stream.

2. All fishing is prohibited in all salmon streams, their tributaries and lakes, and within 500 yards of the mouths of such streams flowing into the Pacific Ocean or Bering Sea between Cape Spencer and Cape Newenham, except as follows:

(*a*) Fishing is permitted in Bering River below a line extending at right angles across Bering River from a point approximately 800 feet northwesterly from the mouth of Gandil River.

(*b*) Fishing is permitted in Copper River and its tributaries in accordance with the terms of the order promulgated December 20, 1918, which order is continued in full force.

(*c*) Fishing is permitted at Karluk beyond the zone 100 yards outside the mouth of Karluk River where it breaks through Karluk Spit into Shelikof Strait.

(*d*) Fishing is permitted in Ugashik River below a line extending at right angles across the Ugashik 500 yards below the mouth of King Salmon River.

3. The driving of salmon downstream and the causing of salmon to go outside the protected area at the mouth of any salmon stream are expressly prohibited.

4. This order does not apply to persons taking salmon with rod, hand line, or spear for their personal or family use and not for sale or barter.

5. The waters of the Afognak Reservation are covered by presidential proclamation of December 24, 1892, and the regulations promulgated by authority thereof are not modified or affected by this order but remain in full force.

6. All previous orders of the Secretary of Commerce imposing limitations or prohibitions upon fishing in the waters covered by this order, except as hereinbefore indicated, are hereby superseded.

7. This order became effective January 1, 1920.

On May 22, 1920, announcement was made of a hearing to be held at Seattle on November 23, 1920, at which it is proposed to elicit information in respect to what further restrictions, if any, should be placed on salmon fishing in the Yukon River.

Under date of May 25, 1920, announcement was made of a hearing to be held at Seattle on November 30, 1920, for the purpose of securing information as to whether restrictions in addition to those already imposed by law should be placed upon fishing in the Kuskokwim River.

Request having been made for a reconsideration of the existing salmon-fishery regulations for the Copper River, announcement has been made of two hearings, one at Cordova, Alaska, October 5, and one at Seattle, Wash., November 18, 1920.

ALASKA FUR-SEAL SERVICE.

GENERAL ACTIVITIES.

The scope of the Bureau's work in connection with the Pribilof Islands is far more extensive than is generally realized. Major activities include the administration of affairs pertaining to the fur-seal and fox herds, with annual products now averaging between $2,000,000 and $3,000,000, and the welfare of the native inhabitants, numbering upward of 300 persons, who in a sense are wards of the Government. The work thus not only covers the management of a large commercial enterprise but involves civic and municipal duties under conditions unlike those existing elsewhere in the world.

The natives of the Pribilof Islands are essential for carrying on the fur-seal industry. Without them it would be practically impossible under present conditions to conduct the laborious operations connected with the killing and skinning of seals and the curing and shipping of the pelts. The natives perform their work faithfully for the most part and take a keen interest in securing the best results. In return for their efforts, the natives are allowed certain cash compensation for fur-seal and fox skins taken, and in addition are supplied with food, clothing, fuel, shelter, and medical attention. The distribution of supplies is prorated in accordance with the size of families. Suitable schools are maintained for the native children. Housing conditions are unsatisfactory, but this situation is being remedied as rapidly as possible with the funds available. Most of the dwellings were built 40 or 50 years ago and are badly in need of replacement. Recently a model concrete house was completed for native use. If after a season's occupancy this type proves satisfactory, as it is believed it will, further buildings of the same kind may be constructed. On March 31, 1920, the number of natives resident on St. Paul Island was 188 and on St. George Island 128, a total of 316.

On December 31, 1919, the Commissioner of Fisheries had in his custody, as trustee for certain of the natives, the sum of $3,093.57. These funds are kept on deposit with the Washington Loan &

Trust Co., Washington, D. C., and draw interest at the rate of 3 per cent per annum, calculated on monthly balances. Liberty bonds purchased by the natives through the Bureau of Fisheries had, at the end of the fiscal year 1920, been forwarded to their owners or disposed of in accordance with their wishes.

The purchase of supplies for the Pribilof Islands has been a large undertaking. In 1919 the goods were assembled at Seattle, Wash., whence transportation was afforded to the Pribilof Islands chiefly by the U. S. S. *Nanshan*, through the cooperation of the Navy Department. Certain supplies in excess of the *Nanshan's* capacity were forwarded by commercial steamer to Unalaska. In 1920 the Navy Department again cooperated by shipping supplies on the the U. S. S. *Saturn*, which vessel also acts as tender for the Alaska naval-radio stations.

The Coast Guard, through its vessels detailed for Alaska service, has from time to time rendered valuable assistance in the transportation of supplies and persons in connection with the Bureau's work at the Pribilof Islands.

The *Eider*, a vessel with carrying capacity of from 40 to 50 tons, purchased last year by the Bureau for use as local tender at the Pribilofs and for trips between there and Unalaska, the nearest port, 250 miles distant, has proved of great value. It is noteworthy that the *Eider* made a trip from Unalaska to the islands in the middle of winter. No vessel had ever before visited the islands at that time.

Among more notable improvements at the islands in the past year have been the construction of two new salt houses for curing sealskins, the erection of a garage to house the four tractors and two trucks in use on St. Paul Island, the construction of two new native dwellings, one of concrete, and improvements to the landings both on St. George and St. Paul Islands. The four tractors sent to St. Paul Island in the fall of 1919 have been of great value in hauling sealskins from killing fields to the salt houses, and in moving seal carcasses from the fields to the by-products plant.

The Navy Department has continued the maintenance of radio stations on St. Paul and St. George Islands. They have been of incalculable value in affording communication with the outside world at all times of the year.

Attention is invited to the necessity of augmenting the personnel of the Pribilof Islands. The best interests of the Government require that the present staff be increased by a biologist or naturalist to give sustained consideration to the scientific problems involved in the fur seals, foxes, and other life on the islands, and by several technical assistants.

THE FUR-SEAL HERD.

The census of the seal herd as of August 10, 1919, showed 524,235 animals of all ages in the herd, an increase of 27,803 over the corresponding figure for 1918. The tentative figures for the census of 1920 indicate 548,473 seals as of August 10, 1920, or an increase of slightly over 24,000 in the year. The increases from year to year are net, the seals killed in the period between the censuses having been deducted. The census in 1920 was again taken under the immediate supervision of Dr. G. Dallas Hanna.

In the calendar year 1919 there were taken on St. Paul Island 24,053 sealskins and on St. George Island 3,768, a total of 27,821. Of these skins, 2,513 were from seals 6 years of age and 5,218 from seals 7 years of age and upward, in an effort to reduce the number of old surplus bulls. In 1920 there were taken through August 10, 21,936 skins on St. Paul Island and 4,042 on St. George Island, a total of 25,978. The take for 1920 will be increased somewhat by fall killings to provide food for the natives.

The provisional quota of seals to be killed at the Pribilof Islands in the calendar year 1920 was fixed at 35,000, of which 31,000 were to be taken on St. Paul Island and 4,000 on St. George Island; but as the sealing season progressed it became apparent that the surplus adult males, which constituted about 25 per cent of the contemplated quota, were not present in the expected numbers. On the recommendation of the responsible agents of the islands telegraphic authority was given to take, in addition to the numbers previously determined, 3,000 3-year-olds and 1,000 4-year-olds, these classes of seals being present in sufficient abundance on St. Paul Island to fully warrant the increased killings.

The different elements of the fur-seal herd, as determined by recent observations, now closely approximate the proper proportions in respect to the various age classes. The efforts of the past two seasons to reduce the excess of breeding males have been successful, as indicated by the fact that the average number of cows per harem increased from 30 in 1919 to 41 in 1920.

Experimental work in the season of 1920 may lead to the adoption of marked changes in methods of handling fur-seal skins, but final decision must await the outcome of the dressing and dyeing. The experiments have included an improved method of salting the skins; the washing of the pelts before salting, in order to remove blood and dirt; and, in addition, there have been extensive practical tests of the advisability of removing blubber from the pelts before salting.

In the fiscal year 1920 three sales of Pribilof Islands fur-seal skins were held at St. Louis. At the first sale, September 10, 1919, 9,055 skins were disposed of at the bid price of $827,112.50. At the second sale, February 2, 1920, 9,100 skins were sold for $1,282,905. At the third sale, May 10, 1920, 5,752 skins brought $424,166. The total number of sealskins sold during the fiscal year was, therefore, 23,907, at the aggregate price of $2,534,183.50. The high prices received are indicative of the excellent quality of the skins, which prior to sale are dressed, dyed, and machined at the modern plant located in St. Louis. The output of this plant unquestionably surpasses anything of the kind ever produced heretofore in Europe or elsewhere.

As a net result of the sales of fur-seal skins in the fiscal year 1920 there was deposited in the Treasury of the United States the sum of $1,457,790.57. This amount represents, in part, some of the skins sold in previous fiscal years for which returns did not come in until 1920. In addition to the amount stated the sum of $271,894.18 was set aside for payment to Great Britain and Japan of the shares to which those nations are entitled under the North Pacific Sealing Convention of 1911.

Pursuant to the provisions of the fur-seal convention, there have been received by the United States 111 sealskins from the Japanese herd on Robben Island. This number represented the 10 per cent share of the United States of the take of 555 skins in each of the years 1918 and 1919. These skins, which had been taken and cured in an excellent manner, were forwarded in March, 1920, to the Department's agents in St. Louis for sale.

BY-PRODUCTS OF THE SEAL INDUSTRY.

Shipments in the fiscal year 1920 of commodities prepared at the by-products plant on St. Paul Island aggregated 20,568 pounds of animal meal, or fertilizer, and 3,000 gallons of oil. The amount received from the sale of fertilizer was $771.30, and for the oil $3,640. An excellent grade of oil was produced. The plant was again operated in the season of 1920, but shortage of labor and fuel limited operations, with the result that 29,000 pounds of fertilizer and 1,800 gallons of oil were produced. An expert was employed for the operation of the plant. It is expected that hereafter the work will be conducted along more extensive lines.

FOXES AND REINDEER.

The blue-fox herds on the Pribilof Islands as a source of revenue to the Government are largely dependent on the sealing industry. Without the food provided from seal carcasses the fox herds would disappear as a commercial proposition. St. George Island is a far more prolific producer of fox pelts than St. Paul. On St. George there has been developed a method of control that has not yet been adopted on the other island. The animals are fed regularly through the winter with seal meat preserved from killings of the preceding summer, and they are captured in specially constructed traps which permits the release of an adequate and healthy breeding reserve.

In the season of 1919–20 there were taken on St. Paul Island 155 blue-fox pelts and 33 white-fox pelts, and on St. George Island 746 blue-fox pelts and 4 white-fox pelts, a total of 901 blue pelts and 37 white pelts. This was the largest production in many years. The yield of both islands in the preceding season was 667 blue skins and 30 white skins. The white fox on the islands represents a color phase of the blue fox, and, as it is far less valuable, every effort is made to eliminate it from the herds. It is expected that over 1,000 blue-fox skins may be taken in the coming winter.

The blue and white fox skins taken at the Pribilof Islands in the winter of 1918–19, with the exception of two withheld for exhibition purposes, were sold at public auction at St. Louis on September 10, 1919. Six hundred and sixty-five blue pelts and 30 white pelts made up the sale. The blue pelts brought $130,274.50, an average of $195 each, and the white pelts $1,660, an average of $53.33 each.

According to the best available figures, there were 164 reindeer on St. Paul Island and 123 on St. George Island at the end of the year 1919. This is a net increase of 18 over the year before. During 1919, 36 reindeer were used for food, thus affording a welcome change in diet. The herd is in a flourishing condition, having increased to its present proportions from the original stock of 40 animals introduced on the islands in 1911.

MINOR FUR-BEARING ANIMALS OF ALASKA.

VALUE OF FURS PRODUCED.

The value of the furs shipped from Alaska in the year ending November 15, 1919, exclusive of those from the Pribilof Islands, was, according to statistics compiled by the Bureau, $1,379,347.66. The corresponding figures were $1,305,421.16 for 1918 and $1,028,719.05 for 1917. The principal furs shipped in the last year were 7,723 red-fox pelts, valued at $270,305; 4,575 white-fox pelts, valued at $210,450; 28,040 mink pelts, valued at $252,360; and 113,652 muskrat pelts, valued at $215,938.80. The statistics of fur shipments were collected as in previous years by requiring shippers to report all consignments of furs from Alaska. The Post Office Department continued its cooperation in having postmasters report all shipments of furs by mail. As a check on reports of furs from Alaska made otherwise than by mail, the records of the customshouse at Juneau are available for examination.

REGULATIONS AND VIOLATIONS.

No change was made during the fiscal year in the departmental regulations for the protection of fur-bearing animals in Alaska, except that the close season on sea otters was extended for an additional period of five years, or until November 1, 1925. While it appears that the numbers of sea otters in Alaska are increasing somewhat, it seems highly desirable to continue in the inshore waters the protection that is afforded offshore by international agreement.

A considerable number of seizures of unprime furs was made during the year. The regulations forbid the taking of unprime furs at all times. A very important seizure was that made in July, 1919, of marten and beaver pelts, which had been mailed in Alaska, the killing of beaver and marten being prohibited throughout the year in Alaska. The seizure was made through search warrants acquiesced in by the Post Office Department and consisted of 714 marten skins and 699 beaver skins. The right of the Government to seize and hold these skins was contested, and at the end of the year the matter was still undecided by the courts.

FUR FARMING IN ALASKA.

On December 31, 1919, five islands were under lease to individuals or firms for the propagation of foxes and other fur-bearing animals—viz, Chirikof, Long, Marmot, Little Koniuji, and Middleton. The annual rental received was $200 or $205 for each island.

Fur farming continues to be carried on by a number of persons in Alaska. Operations are concerned chiefly with the breeding of foxes. Whether intensive fox farming will prove in the end successful can not be foreseen at present. In all probability the raising of foxes on islands where the animals are permitted to run at large will continue to be profitable to those who are so situated as to take advantage of conditions.

TRANSFER OF JURISDICTION.

The act making appropriations for the Department of Agriculture for the fiscal year 1921, approved May 31, 1920, contained a provision that the jurisdiction heretofore exercised by the Secretary of Commerce over land fur-bearing animals in Alaska, the Pribilof Islands excepted, be transferred to the Secretary of Agriculture. This transfer has for several years been advocated by the Bureau of Fisheries. The act further provides that jurisdiction in the matter of leasing certain islands in Alaska for the propagation of foxes and other fur-bearing animals be also transferred from the Secretary of Commerce to the Secretary of Agriculture. At the same time the jurisdiction over walruses and sea lions previously vested in the Secretary of Agriculture was transferred to the Secretary of Commerce.

MISCELLANEOUS.

APPROPRIATIONS.

The regular appropriations for the support of the Bureau of Fisheries for the fiscal year 1920 aggregated $1,206,190. The specific purposes for which the appropriations were made and the amount thereunder were as follows:

Salaries	$434,190
Miscellaneous expenses:	
Administration	11,000
Propagation and distribution of food fishes	400,000
Maintenance of vessels	120,000
Inquiry respecting food fishes	45,000
Statistical inquiry	15,000
Protecting sponge fisheries	3,000
Protecting seal and salmon fisheries of Alaska	125,000
Officers and crew of vessels for Alaska fisheries service	26,000
Special appropriations:	
Cape Vincent (N. Y.) fish hatchery, general repairs	8,000
Duluth (Minn.) fish hatchery, foreman's cottage	4,000
Wytheville (Va.) fish hatchery, general improvements to water supply	5,000
Fairport (Iowa) biological station, additional amount for rebuilding laboratory	10,000

The following deficiency appropriations, amounting to $132,500, became available during the year:

Maintenance of vessels	$5,000
Inquiry respecting food fishes	500
Protecting seal and salmon fisheries of Alaska	2,000
Baker Lake (Wash.) hatchery, replacing buildings destroyed by fire	50,000
Woods Hole (Mass.) station, replacing machine shop and power plant	70,000
Fairport (Iowa) biological station, equipment	1,000
Wytheville (Va.) station, improvement to water supply	4,000

In accordance with law, a detailed statement of the expenditures under the regular and deficiency appropriations will be duly submitted.

BUILDINGS AND IMPROVEMENTS.

The special appropriation for the construction of a foreman's cottage at the Duluth, Minn., station has not been used. Proposals were received from a number of contractors for the work, but none of a satisfactory nature within the limits of the appropriation were received.

At the Cape Vincent, N. Y., station there has been satisfactory progress in making the improvements contemplated. The most important items are the general remodeling of the interior of the hatchery building. This involves new windows, floors, and floor joists, the reinforcing of the stone walls of the building, and the general rearrangement of the hatching batteries, pumps and heating plant, all making for economy in space and convenience in operation. A 10-inch suction pipe from the end of the dock to the pumps has been laid and a new pump installed. Concrete piers, to serve as a foundation for an 18,000-gallon wood-stave tank supported on a steel tower, material for which has been ordered under contract, were in place at the close of the year, and the construction of a whitefish battery of an improved type, together with a building to shelter the fry tanks, was under way.

The special appropriation of $50,000 for the reconstruction of buildings at the Baker Lake station, which were destroyed by fire on July 21, 1919, became available in November and work was immediately undertaken. A new frame hatchery 56 by 130 feet, equipped with 150 standard salmon-hatching troughs with a capacity for at least 40,000,000 sockeye-salmon eggs and fry will be ready for occupancy during the 1920 spawning season. In addition, a temporary shelter containing 40 hatching troughs was completed in time to successfully handle the large egg collections made in the fall of 1919. All the lumber used has been cut on the grounds by means of a sawmill purchased and installed for the purpose. This mill will be a valuable permanent adjunct to the station.

The special appropriation for the improvement of the water supply at the Wytheville (Va.) station has been used in the installation of approximately 4,000 feet of 14-inch wood-stave pipe. The work involved the construction of a cement dam in Tates Run, from which point the water is taken, the excavation of a ditch 3 feet deep by 2 feet wide and 4,000 feet long, 500 feet of which were blasted from solid rock, and the construction of a dam and four bulkheads of cement where the line crosses the creek. The complete installation increases the water supply by approximately 1,500 gallons of water per minute. The laying of this line necessitated the purchase of a right of way across intervening land.

The new biological laboratory at Fairport, Iowa, to take the place of the one destroyed by fire, is practically completed and was ready for occupancy in the summer of 1920. The building is of concrete, stone, and brick construction, and is designed to be fireproof. The outside dimensions are 101 feet 8 inches by 54 feet 6 inches. The main floor comprises two office rooms, four biological laboratories, and a chemical laboratory, besides a room of two compartments for embedding and microtome work, a stock room and a museum with adjoining work room. On the second floor are a large and well-lighted library, 2 laboratories, 10 bedchambers, 3 bathrooms, and linen closets. The third floor, which is completed only over the center or main portion of the building, comprises 10 rooms which may serve as required for bedchambers, storage, and other appropriate purposes. In the basement there are a boiler room, a coal vault, dynamo room, two storage rooms, packing room, dining room, pantry, and kitchen, and finally two large rooms for tanks and an aquarium. The floors are concrete except in the library. Marble terrazzo is employed for floors in bathrooms, in first and second story public halls and corridors, and on main stairways. The building is equipped with electric lights and with conduits for an intercommunicating telephone system. It is steam heated, provided with hot and cold water, and is piped for gas in the principal laboratories.

Plans for a boiler and engine house and machine shop at the Woods Hole (Mass.) station, to replace the wooden structure, which was burned in March, are completed and the contract will be let at an early date.

VESSEL SERVICE.

At the beginning of the fiscal year the steamer *Albatross* was at Baltimore fitting out and being put in order for the Bureau's needs after her use by the Navy. Considerable additions were made to her equipment, including a powerful modern dredging winch and an otter trawl. She sailed October 27 for a cruise in Florida and Cuban waters to initiate fishery investigations to serve as a basis for further operations by the ship during the next two years. Biological and physical oceanographic stations were occupied on four sections across the Gulf Stream between Cape Henry and Key West: Across Florida Strait, between Key West and Habana; from Habana to Cape San Antonio at the western end of Cuba; across the Yucatan Channel to Cape Catoche; and from Cape Catoche to Dry Tortugas. The vessel returned to Baltimore on January 1, 1920.

On February 16 the *Albatross* sailed for Boston, arriving there February 24, and making this port headquarters for fishery and oceanographic investigations in the Gulf of Maine. This was a continuation of investigations conducted in the same waters by the *Grampus*, beginning in 1912. On the trip to Boston the vessel made three hauls with a 60-foot otter trawl in the vicinity of the 100-fathom curve, with the purpose of determining the occurrence of tilefish and other ground fish off the middle Atlantic coast; she also occupied a series of hydrographic stations on a line across Georges Bank. The work in the Gulf of Maine lasted until April 21.

On May 3 the *Albatross* started an inquiry regarding the spawning habits of the haddock in the Gulf of Maine. This work lasted until May 19, when the vessel returned to Baltimore, arriving May 20. A general survey of the ship was made on May 25. While she was found to be in generally good condition, certain repairs and improvements were authorized and were in progress at the end of the fiscal year.

Owing to the inability of obtaining satisfactory scientific assistants it was not possible to utilize the steamer *Fish Hawk* during the first half of the fiscal year, but on January 10 active operations were undertaken. A hydrographic and biological survey of Chesapeake Bay was commenced, to be carried out by a series of cruises, each of one to two weeks' duration, at approximately monthly intervals. This work is being continued with satisfactory results. The vessel is in excellent condition.

During the summer and fall of 1919 the steamer *Halcyon* was attached to the Gloucester (Mass.) station and assisted in fish-cultural work during the season. In January, February, and March she performed valuable service in keeping the channel in Gloucester Harbor cleared of ice, so that fishing vessels could enter and depart.

When the *Halcyon* was turned over to the Navy at the beginning of the war, she was not entirely completed and equipped. This need has been met, and the vessel has been put in condition for the Bureau's purposes. Some desirable alterations in her interior have been made, a heavy gun platform has been removed from the forward deck, her engine and machinery have been overhauled, and bilge keels have been built on. An electric-light plant has been installed, and a dredging winch with appropriate gear and apparatus has been provided. The work is practically completed, and the vessel is ready for service.

The auxiliary schooner *Eider*, purchased during the last fiscal year for service at the Pribilof Islands, left Seattle on October 26 for the islands with coal and other supplies and with several Government employees, reaching her destination on November 22. Headquarters for the winter were established at Unalaska, there being no harbor or suitable anchorage at the islands. During the year the vessel has been almost constantly employed as a tender, operating between the Pribilof Islands and Unalaska. Trips were made as the weather permitted in January, April, May, and June. The vessel has proved satisfactory for the service required.

The steamer *Osprey* was engaged as a fishery patrol boat in southeastern Alaska waters until August 6, 1919. She was then reported to be in an unseaworthy condition, and for the remainder of the year was laid up at Cordova. The *Osprey*, which is 25 years old, was purchased by the Bureau in 1912 for $13,000, and has given nearly eight years of hard service. She has now outlived her usefulness, and, as it was believed inadvisable to devote any large amount of money to put her in first-class condition, she has been condemned, and sale has been authorized.

The two small fishery patrol boats *Murre* and *Auklet* have performed excellent service, being constantly employed in southeastern Alaska waters during the entire year. From November 1 to March 31 the *Murre* was loaned to the Bureau of the Census for the use of census enumerators. This vessel has met with two accidents during the year. She caught fire on December 3, 1919, with the result of considerable damage to the vessel and loss of personal property of the crew. On April 1 she struck a rock and was beached in consequence. An investigation showed that both of these accidents were unavoidable and no blame has been attached to the personnel of the boat. She has already been repaired and is in active service.

The *Phalarope* and the *Gannet* have been engaged as usual in fish-cultural work, the former in connection with the Woods Hole (Mass.) and Bryans Point (Md.) stations, the latter at Boothbay Harbor, Me.

In addition to the vessels mentioned in the last annual report, there have been transferred to the Bureau by the Navy Department the motor boats *Raco*, *Edithena*, and *Wachussetts*. The *Raco* has been rechristened the *Kittiwake* and assigned to the Gloucester (Mass.) station for fish-cultural work, but no definite assignments have been made of the other two. It is believed that they will prove of value in some of the activities of the Bureau.

A new motor boat, the *Tern*, was constructed in April for use on the lower Yukon River and in the delta waters. The vessel is 38 feet long and is equipped with a 35-50-horsepower engine.

PUBLICATIONS AND LIBRARY.

The limitation imposed by Congress on the publications of the Bureau is proving a considerable drawback. Most of the Bureau's documents are intended to serve a definite public purpose, looking to the conservation, maintenance, or proper utilization of aquatic creatures. Such publications are therefore deserving of wide distribution within proper limits if their purpose is to be achieved. Many of the printed reports are the result of protracted inquiry or investigation and pertain to the welfare of important branches of the fisheries and fish culture in extensive areas where it may be desirable, if not necessary, to reach thousands of persons. In these circumstances, to restrict editions to 1,000 copies, regardless of their cost or regardless of the exigencies of the particular public fishery situations intended to be met, and to prohibit the issuance of reprints during the same year in which the original reports were published, may defeat the Bureau's efforts to render a service for which there is a great public demand. The major cost of publications is not in paper and presswork and may be not even in composition, but in the labors and expenses of investigators. It would, therefore, seem unwise in the case of many of the Bureau's documents to exercise economy only with regard to their least expensive feature.

The publications issued during the year have been carefully considered and designed in all cases to meet a public need. The free distribution of documents has been restricted and mailing lists have been revised. The series of economic circulars has been added to and continues to serve the useful purpose of supplying practical information on timely subjects at insignificant cost. The limitation on the size of editions acts as a special handicap in the case of these documents.

A noteworthy work accomplished by the librarian is the completion of an analytical subject bibliography of the Bureau's publications from 1871 to 1920. These publications constitute a library in themselves, and, without doubt, are the most complete and comprehensive collection extant on the fishery industries, fish culture, and aquatic biology and physics. More than 6,700 titles occur, and, in order to make the matter available for reference, intelligent compilation and classification are necessary. It is proposed to print this bibliography in convenient and inexpensive form, appearing opportunely at the close of the first half century of the Bureau's existence.

DISINTEGRATION OF THE PERSONNEL.

As the concluding section of this report, special attention is invited to the matter of fair compensation for the loyal and efficient employees of the Bureau in Washington, in the field, and afloat. It is hoped that affirmative action may be taken by Congress on pending relief measures that affect the force in the District of Columbia and that there may also be a readjustment of salaries throughout the field service.

A very serious situation confronts the Bureau because of the disintegration of the trained corps of specialists in all branches of the service, owing to the insufficient salaries allowed by Congress. With the cost of living increased at least 100 per cent in the past 10 years, the bonus provided by Congress, while most desirable and acceptable, must be regarded as a wholly inadequate, purely palliative, and manifestly temporary expedient. No bonus and no salary increase have been accorded an important part of the Bureau's personnel responsible for the wise planning and efficient direction of the work.

The Bureau has, therefore, been obliged to submit to the loss of valuable employees and the crippling of its technical staff that represent years of special training in order to equip them for the peculiar needs of the fishery service, because of the notoriously low compensation allowed by Congress and the much more attractive positions outside the Government. Unskilled laborers and low-grade mechanics are receiving wages that in many cases far exceed the compensation allowed by law for high-grade experts in the Bureau's service, while technical positions of responsibility and importance comparable to those in the Bureau command salaries in private life that are from two to four times those paid by the Government.

It is therefore not strange that the Bureau should have lost through resignations one-third of its scientific force and that other resignations therein are pending, resulting in the disorganization of a staff that has taken years to build up, will require years to reestablish under most favorable conditions, and can never be replaced so long as the Government offers no financial inducements. In the fish-cultural service, owing to low compensation, about two-thirds of the statutory positions in the lower grades have been either vacant or filled temporarily by old men and boys without qualifications, and in many cases even incompetent persons have refused to accept employment at the meager rates of pay offered by the Government. At one western station the superintendent and one other employee have been the only members of the statutory force for more than two years, while in other fields the work of important auxiliary stations has of necessity been put in charge of inexperienced, temporary men, or mere apprentices.

No private establishment would be expected to function under the conditions that have been confronting the Bureau for several years and have become more acute each year. Prompt and radical measures are now imperatively demanded if complete disorganization of the force is to be obviated.

Respectfully submitted.

H. M. Smith,
Commissioner of Fisheries.

To Hon. J. W. Alexander,
Secretary of Commerce.

THE FISHERIES BIOLOGICAL STATION AT FAIRPORT, IOWA

By R. E. Coker
Assistant in Charge of Scientific Inquiry
U. S. Bureau of Fisheries

Appendix I to the Report of the U. S. Commissioner of Fisheries for 1920

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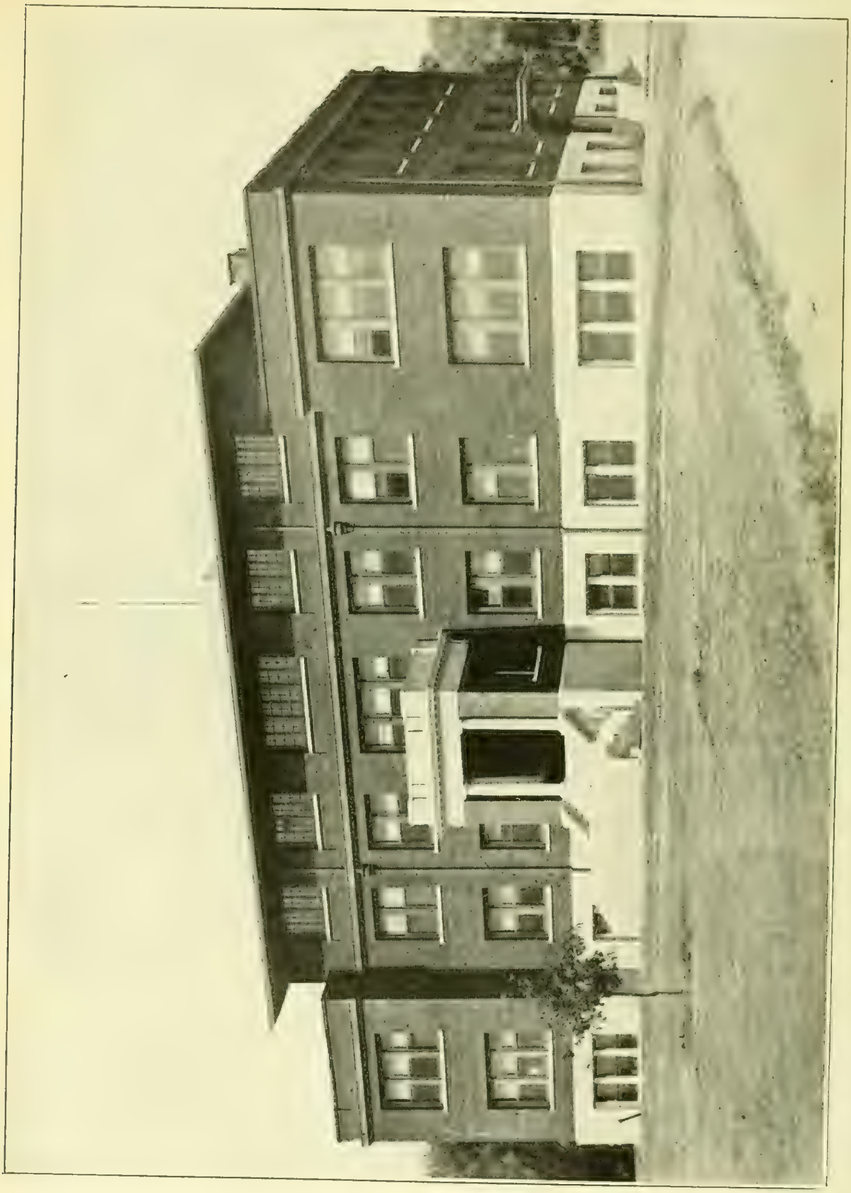

THE NEW BIOLOGICAL LABORATORY BUILDING, COMPLETED IN 1920.

THE FISHERIES BIOLOGICAL STATION AT FAIRPORT, IOWA.

By R. E. Coker, *Assistant in Charge of Scientific Inquiry, U. S. Bureau of Fisheries.*

HISTORY AND FUNCTIONS.

The Fairport station was established by act of Congress in 1908. Its construction was begun in 1909, and with temporary equipment it began operations in June, 1910. The old laboratory, a frame structure of approximately the same dimensions as the present fireproof building, was constructed in 1912 and 1913. At the formal dedication of the building on August 4, 1914, unusual public interest was manifested by the attendance of 5,000 persons and by the congratulatory addresses delivered by men of prominence in public life and by scientific men of established repute. This building was unfortunately destroyed by fire on December 20, 1917. The office furniture and files and such scientific records as were retained in the office in original or duplicate form were saved; but records embodying results of tedious investigations were lost, together with the scientific equipment. A chief loss was the library, which, though not large, included a rare collection of separate papers and monographs, particularly such as related to fresh-water mussels of America and Europe.

Fortunately, the station comprised a great deal more than the laboratory building. The ponds and water system remained intact. The personnel of the station adapted itself readily to the changed conditions, and the important scientific and administrative work of the station was promptly resumed in the cramped quarters afforded by the old "temporary laboratory," a small one-story building just below the railroad, which had served a similar purpose in the first years of the station's history. For nearly three years valuable scientific work was carried on in these poor quarters, both by the permanent scientific staff and by a limited number of specialists in temporary association with the Bureau—men and women to whom personal convenience or comfort was secondary to the achievement of the objects to which the station was dedicated.

An appropriation of $80,000 was promptly made by Congress for the erection of a new and fireproof building. This, supplemented by two small additional appropriations, made it possible to build and partially to equip the present admirable building of brick, stone, and concrete. Experience gained during the occupancy of the old building, the resourcefulness and skill of the architect,[1] and the good spirit manifested by the constructing company, all combined to make the new building superior in available space, convenience, and serviceability, and an exceptional value in proportion to cost.

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[1] Prof. James M. White, professor of architecture and supervising architect of the University of Illinois.

After unavoidable delays arising from the conditions of national emergency, the new laboratory was completed and occupied in August, 1920. Again there was a demand upon the Bureau for the observance of exercises of dedication, and these were set for October 7, in connection with a Conference Regarding the Application of Science to the Utilization and Preservation of the Resources of our Interior Waters (October 7 and 8). The occasion was made impressive, helpful, and inspiring through the whole-hearted cooperation of representatives of the Government, business men, and scientists from the leading American universities. Recognition of the national significance of this biological station for investigation of problems of fresh waters was attested by the presence of delegates from 22 universities and colleges and from two independent scientific organizations, representing 14 States, from California on the west to Massachusetts on the east, from Oklahoma and Florida on the south to Wisconsin and Michigan on the north.

The station serves as a base of operations for a large part of the scientific work of the Bureau of Fisheries in the Mississippi Basin. A primary activity is the propagation of pearly fresh-water mussels; but not less significant are its functions in experimental fish culture, in investigations of various fresh-water fishery problems, and in promoting both a fuller utilization of aquatic products and a broader interest in the protection of aquatic resources, in order that the future, as well as the present, may be properly served.

Through field parties the activities of the station have been extended into most of the States of the Mississippi Basin, and the results of work done go much further than the localities in which operations are conducted. The benefits of service to the mussel industries are felt not only where mussel fishing, or clamming, is practiced, but wherever mussels are manufactured into the finished products of commerce—in New York and Massachusetts, as well as in Wisconsin and Iowa; they are experienced, too, though unconsciously, by all who are consumers or utilizers of buttons. The demonstration at Fairport of the feasibility of propagating the channel catfish in ponds can be made useful for the increase of food supply in other parts of the United States. The propagation and distribution of some hundreds of millions of buffalofish fry in public waters each year is the direct result of experiments originally conducted at the Fairport station. The broader utilization of fishes formerly considered "coarse" or useless is in part the result of practical experiments in smoking fish, conducted during several years at this station. The varied services of the station will be described and illustrated more fully in later pages.

PERSONNEL AND EQUIPMENT.

Every station of the Bureau is regarded as an agency through which as complete a public service is to be rendered as conditions allow, but it is evident that the Fairport station combines in a somewhat unique way the functions of a fisheries biological station and a fish-cultural experiment station. This it does because of the provisions of personnel and equipment authorized by the Congress and because of the conditions of its location and origin.

There is attached to the station a small permanent staff of scientists, fish-culturists, and other employees necessary for continuous operation and uninterrupted experimental work. During some parts of the year, as may be desirable and practicable, the personnel responsible to this laboratory is much enlarged. The temporary associates or employees, comprising investigators skilled in special lines, scientific assistants, practical fishermen, or others, make it possible not only to increase the effectiveness of the station, but to broaden the territory of its operations.

About 60 acres of land, extending from the banks of the Mississippi, on a two-fifths of a mile front, to the brow of a hill a quarter of a mile back, afford ample space for the distribution of ponds and the suitable location of buildings. The slope of the ground is such as to assure proper drainage and to make it feasible to have a gravity flow of water from the storage reservoirs, located on or beneath the ground at suitable elevations, to the ponds and buildings.

There are in all 36 ponds, 14 of which are small and made of concrete, and 22 of which are dug out of the earth, simulating the conditions of natural ponds and varying in area from one-tenth of an acre to an acre or more. There are two water systems, the natural river water, pumped into a large storage reservoir and flowing thence to the several ponds, and filtered river water which is stored in low and high pressure cisterns and used for domestic and laboratory purposes. There is also a complete underground sewage and drainage system, which conveys the waste water and sewage into the river well below the source of supply.

The buildings comprise a main laboratory building, a small tank house, a boiler and pump house, a boat and seine shed, a storehouse and carpenter shop, a small shell-testing shop, and other necessary living houses and outbuildings. In some of these will be found pumping machinery for the two water-supply systems, machinery for cutting and finishing buttons in testing work, and such shop and field tools as are necessary to make the station as nearly self-contained as practicable.

The principal building, of concrete, stone, and brick, with ground dimensions of approximately 100 by 55 feet, has a fully finished basement besides two full stories and a finished third story over the center and larger portion of the building. The present laboratory accommodations for 16 investigators can be extended by conversion of other rooms into laboratories. A well-lighted library, chemical laboratory, photographic room, museum, tank, and aquarium rooms are features of the building essential to the efficient accomplishment of biological and chemical investigations of fishery problems. To afford necessary accommodations for temporary investigators at certain seasons, there are provided also a kitchen, a dining room, and a number of bed chambers which may be converted into laboratories as required. The building is lighted by electricity.

SERVICE RENDERED.

WHAT IS DONE FOR MUSSEL INDUSTRIES.

The services of the Fairport station to the pearly mussel industries have consisted in the propagation of mussels, the survey of mussel resources, the investigation of mussel problems, and the promotion of the protection of mussels.

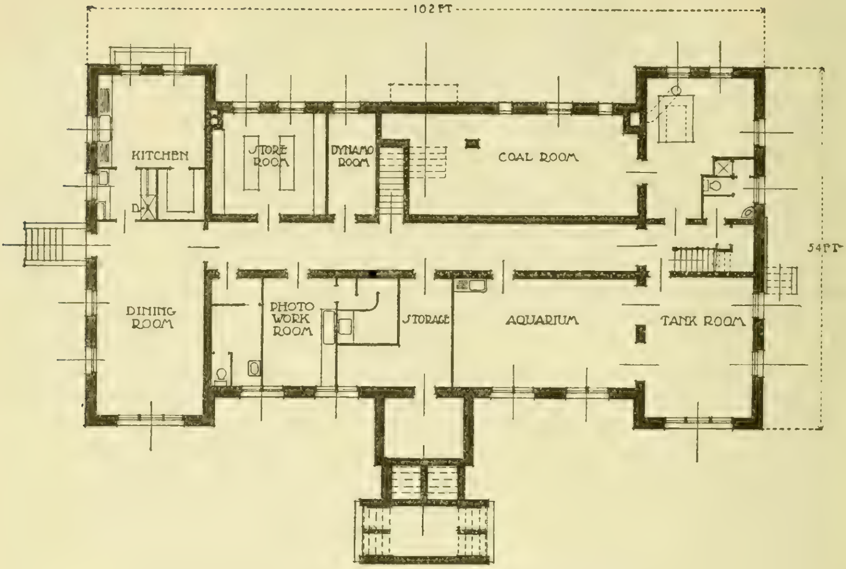

FIG. 1.—The biological laboratory, ground floor plan: D, ice box.

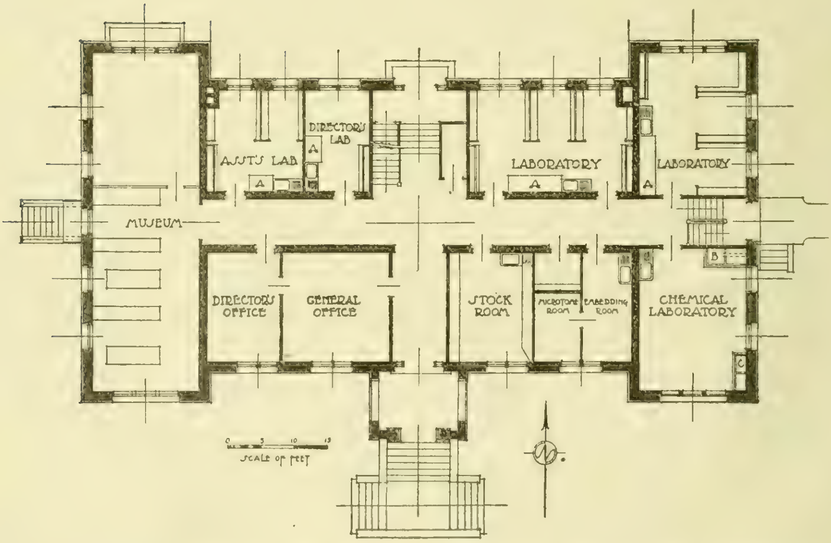

FIG. 2.—The biological laboratory, first floor plan: A, tank table; B, chemical hood; C, balance slab.

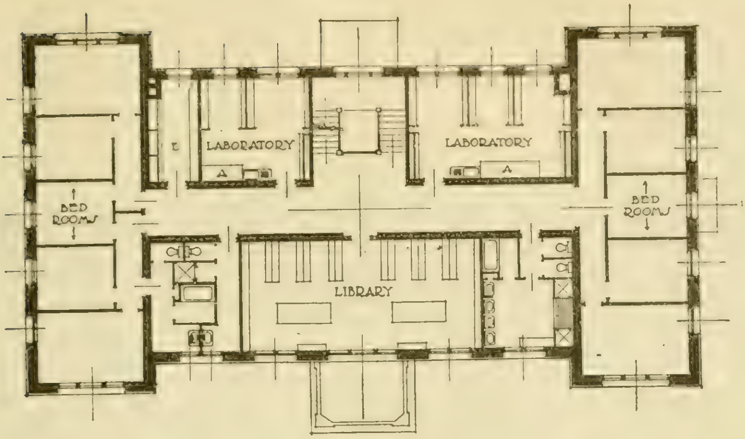

FIG. 3.—The biological laboratory, second floor plan: A, tank table; E, linen closet.

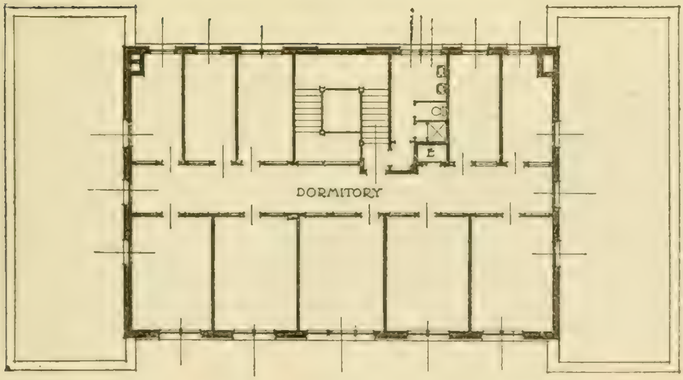

FIG. 4.—The biological laboratory: E, linen closet.

The survey of resources has resulted in opening new fields, and it helps also to furnish the necessary basis of information for estimate of the perpetuity of the resources, for the adoption of intelligent protective measures, and for guidance in the work of propagation. The special investigations and experimental studies have led to improvements in method of propagation and are pointing the way to further improvements. By investigations in the field and by continued observation of the industries, the Bureau has arrived at a better understanding of the measures necessary for effective conservation of mussels; and, by propaganda, correspondence, publications, and personal conferences, it has been enabled to stimulate more general interest in the subject and to cooperate with State authorities and others in the framing of suitable protective measures.

The enactment and enforcement of such measures must be left to the several States, but a commendable interest has been shown in some States, and a beginning has been made, notably in Wisconsin and Minnesota.

Mussel propagation is carried on by field parties engaged at various places on important rivers. Fishes are seined from the rivers or from overflow waters, are infected with the glochidia (the larval forms of mussels) and then liberated again in the public waters.

The methods of propagation are based upon a peculiar feature of the normal course of development of fresh-water mussels. The very young fresh-water mussels, with rare exception, when first liberated from the incubation pouches of the parent, must become parasitic upon fish in order to pass through the next stage of their existence. To this end, if the chance offers after liberation, the young mussels, or glochidia as they are called in this stage, attach themselves to the gills, fins, or scales of a fish. The mussels of economic importance attach themselves almost exclusively to the gills. In attaching, or biting on the fish, a very slight wound seems to be caused, which begins at once to heal over; but, in the process of mending, the glochidium is overgrown and thus inclosed within the tissues of the fish. The mussel is now actually an internal parasite, in which condition it remains for a period of two weeks, more or less. It is thus conveyed wherever the fish goes, until, when the proper stage of development is reached, it frees itself from the host and falls to the bottom; if, through favorable fortune, it finds suitable lodgment, it continues its growth to form an adult mussel.

The glochidia are so small that the infection, if not excessive, has no apparent injurious effect upon the fish that serves as host. Investigations by the station have shown that mussels do not attach to fish indiscriminately, but that for each species of mussel there is a limited number of species of fish which may serve as hosts.

The task of propagation is to bring together suitable fish and the glochidia of mussels. Careful studies of natural and artificial infections show that a moderate-sized fish may successfully carry in parasitism from 1,000 to 2,000 of the microscopic glochidia, but that under the chance operation of nature few of the glochidia find lodgment upon the proper fish or upon any fish.

During the fiscal year 1920, in round numbers, 183 million glochidia were liberated in parasitic condition. A considerable proportion of these glochidia undoubtedly fall upon unfavorable ground

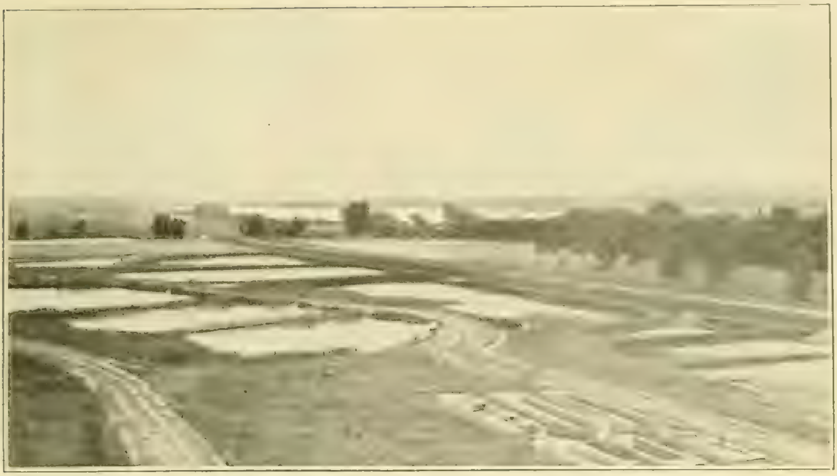

FIG. 1.—PONDS FOR EXPERIMENT WORK.

Earth-walled ponds of various sizes and forms present natural conditions such as may be reproduced on the farm. Small concrete-lined ponds serve the needs of special experiments. Both fish and mussels are reared here.

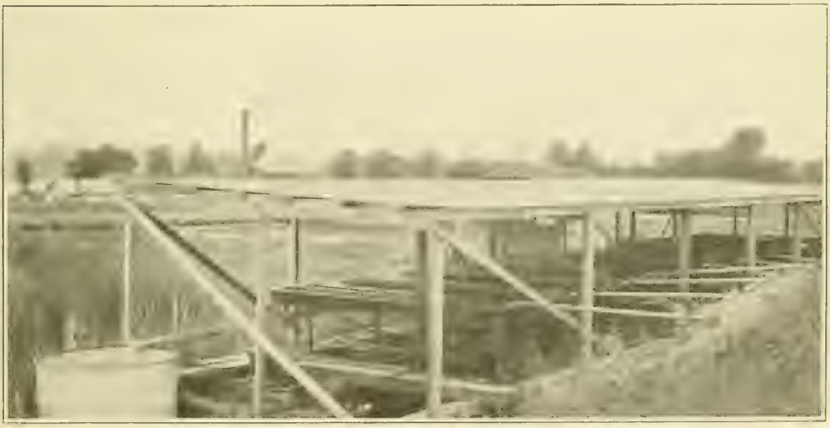

FIG. 2.—TROUGHS FOR REARING MUSSELS.

In troughs supplied with naturally clarified water flowing from near the surface of one of the ponds, the best conditions have been found for rearing several species of fresh-water mussels. As is the fortune of experimental work, success has been variable, but a single trough may produce in one season more than 2,000 young mussels one-fourth to one-half inch in length.

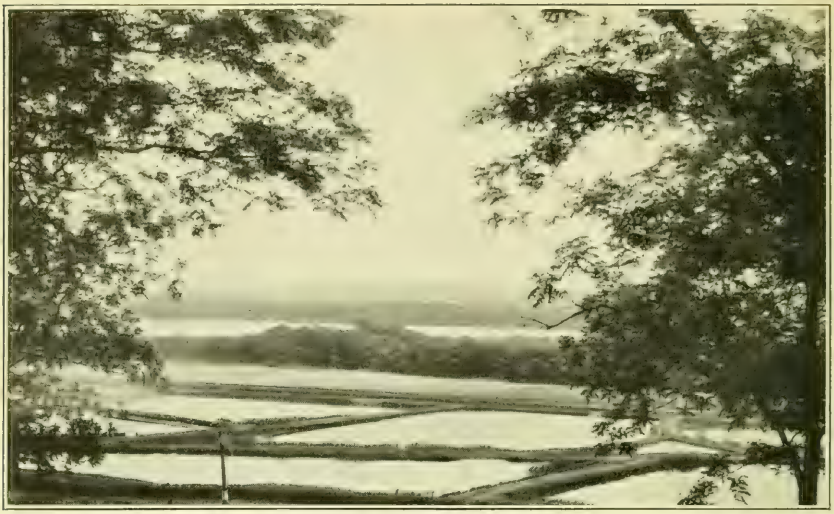

FIG. 1.—PONDS FOR FISH-CULTURAL EXPERIMENT WORK.

Part of the equipment used for fish-cultural experiment work. In these ponds we learn how to rear buffalofish and catfish, and how to make ponds more productive of black bass, bream, and other esteemed game fishes. Mussel culture, too, is practised in these ponds.

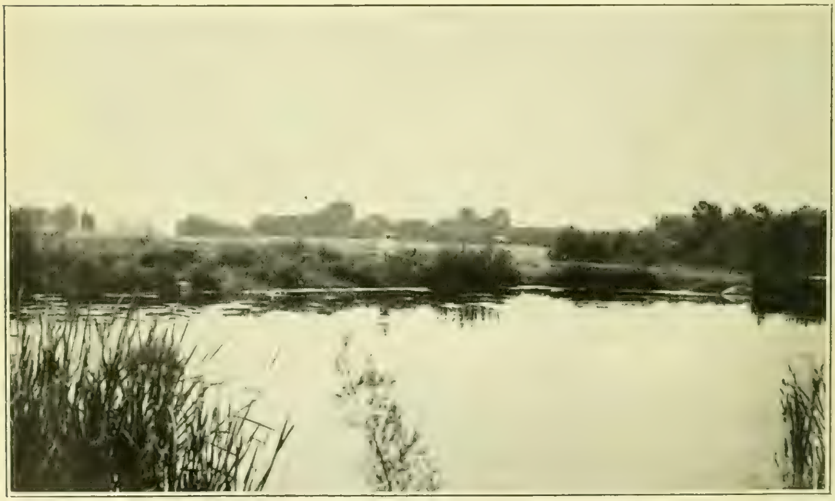

FIG. 2.—A SIMPLE FISHPOND.

This pond, a quarter of an acre in extent, simulates the natural conditions of a farm pond receiving minimum attention. Being stocked with generally esteemed fishes, it is intended to answer the question: What will a small pond yield without special attention?

or fail from other causes to reach maturity. However, it is the large number which can be infected on fish and liberated at small expense that justifies a confidence in the accomplishment of commensurate benefits. The average cost per 1,000 glochidia artificially infected on fish in the fiscal year 1920 was less than 6 cents, inclusive of overhead expenses.

Some of the streams in which this work has been carried on are the Mississippi River, at various points, the Ohio and Cumberland Rivers, the Wabash River in Indiana, and the White and Black Rivers of Arkansas.

In connection with the propagation of mussels, many fishes are rescued from land-locked ponds and restored to the rivers. In this way, during the fiscal year 1920, 36,442 adult and 871,553 fingerling fish were preserved from probable death by suffocation with the drying up of the temporary ponds, and this benefit was accomplished practically without expense additional to that necessarily incurred for the propagation of mussels.[1]

WHAT IS DONE FOR FISH CULTURE.

The services of agricultural and experimental stations to the farmer are so well understood that large appropriations are annually made by the Federal Government and by every State in order that there may be conducted the various sorts of investigations and experiments that are necessary to assist the farmer in producing larger and better crops with the greatest degree of economy. It is likewise important that studies and experiments be carried on to increase the productiveness of streams and lakes and ponds. The grower of fishes is even more dependent than the land farmer upon guidance from governmental experiments. A wheat grower or a cattle raiser has some chance to try out various methods and ascertain the effects by watching the growth of his crops or of his stock. The fish farmer, on the other hand, may try different methods, but he can not see how they work. Furthermore, nearly all of our water areas are under public and not private ownership and control, and only the public is justified in expenditures for experimental work.

Nearly all that we know of fish culture in America has been learned in connection with practical fish-cultural stations, where, since the establishment of the United States Fish Commission 50 years ago, many experiments have been carried out. The accumulated experience of keen and observant fish-culturists is of inestimable value; yet it should be pointed out that the function of a fish-cultural station is to produce as large as possible an output of fry or fingerling fish to be distributed in various waters where others must assume the responsibility for bringing the fish to maturity. It is not the purpose of such stations to work out by tedious experimentation and careful studies the conditions necessary to make individual ponds as productive as possible for market fish. As yet no other station of the Federal Government than Fairport has been designed to serve this function.

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[1] During the first half of the fiscal year 1921, through the cooperation of the National Association of Button Manufacturers, more than 5 million fishes taken in the Bureau's rescue work along the Upper Mississippi River have been infected with mussels and liberated.

A few years ago no catfish except the small bullheads had been successfully propagated, although attempts to breed them in ponds had repeatedly been made. Having at Fairport the facilities and the personnel for continuous fish-cultural experiments, the channel cat, or common spotted catfish, the most favored of the tribe, was chosen as one of the fishes for experiment. Success was not attained in the first two or three years, but finally the right thing was done, and the propagation of the fish was found to be practicable. The methods may be and should be improved, but the results obtained can now be made useful for the promotion of fish culture and increase of food supply.

All attempts at artificial propagation of the buffalofish yielded most discouraging results until this station by properly conducted experiment demonstrated its entire feasibility and thus made a particularly valuable contribution to fish culture. The buffalofish are large species of commercial fish, in good esteem, formerly abundant in the principal rivers of the Mississippi Basin, but of late years diminishing in numbers. The hatching of the eggs of buffalofish by artificial means with the subsequent liberation of the fry or fingerling is now shown to be practicable, and it has been put into practice on a large scale through the fish-cultural stations of the Bureau. There are in progress at Fairport further experiments to determine if this fish may be successfully grown in properly controlled ponds.

Other experiments at this station relate to the growing of game fishes in ponds. Incidental to the experiment work, a considerable number of fish of several species are propagated each year and planted in the Mississippi River.

The task of fish culture is only begun when the fry or fingerling fish are produced and placed in ponds. The success of the pond depends upon the rate of growth of the fish and the proportion of the original stock which survives. The poultry raiser does not overrate his accomplishment when several thousand young chickens are transferred from brooders to yards. His success or failure is measured when the chickens are ready for market, by their number, weight, and quality. If fishes are to be grown successfully in ponds, it is necessary to know upon what they feed and how this food is maintained in the pond, and what other conditions are favorable or unfavorable to the survival and growth of the fish.

Let us again find a partial analogy in the rearing of farm animals. Is the farmer concerned only with his cattle, or does he in the selection, the preparation, and the conduct of his farm, give thought to the growing of pasture plants and hay grain foods? Can he ignore the parasites which cause disease or weakness among his animals; Would he not be stupid to overlook the insects or plant rusts that may sweep his pastures or crop fields bare? Evidently the stock farm is a good deal more than an abiding place for large and useful animals; it is a complex association of cattle, plants, insects, birds, worms, soil bacteria, and what else, not to mention such inanimate things as soil chemicals, water, and air. The fish pond or the fish stream is just as much a complex—more of one, it must be thought, because, though the air on the land farm is ever-present in unlimited quantities, the air in the water farm is limited and variable. Suffocation of the cow in the pasture is never feared, but partial or complete suffocation of fish is a frequent reality. Furthermore, the movements of fish are often governed by distribution of air or waste gases in the water, and the quantity of animal life in the pond is limited by the supply of dissolved gases.

Since the air supply of fish, without which they can not live, varies both seasonably and irregularly, the investigators must study the conditions of occurrence and distribution of gases in ponds and streams that we may learn what is favorable and what is unfavorable to the best conditions of gas content and thus to productivity of useful animals.

Since the air and the chemicals of water and soil are brought to the fish through the intermediation of small plants, small floating animals, creeping insects, and other things, these must all be carefully considered in their relation to fish culture. The relations are complex and the investigators must concentrate attention in different studies upon particular animals or plants. Some of the investigations so far pursued at Fairport relate to the food of the fishes at various stages of development, the kinds of plants that are most suitable and necessary in fish ponds, the relations of certain insect larvæ as food or as enemies of fish, and the occurrence of parasites that weaken the growing fishes and cause them to die or become an easier prey to enemies.

OTHER SERVICES TO FISHERIES.

A good deal of valuable work which is not directly related to mussels or to fish culture is done at and from the Fairport station. A few typical forms of service may be cited.

The construction of the dam across the Mississippi River, about 100 miles below Fairport, at Keokuk, Iowa, gave opportunity for a comprehensive investigation of the effects of water-power developments upon the fisheries of large rivers, and considerable information has been gained as the result of observations continued over a period of several years at Keokuk and at various points both above and below.

Chemical studies pursued in the laboratory have been directed toward ascertaining the food qualities of some aquatic products and possible methods of improving them.

Studies of the diseases of fishes, the causes and remedies, have been pursued. It has been learned that the slight injuries incidental to the handling of fish in warm weather, particularly in rescuing fishes from overflow waters, often lead to bacterial infections which cause serious mortalities. Means of prophylaxis are being devised which may be simple of application and effective in materially increasing the effectiveness of rescue operations in warm weather.

Somewhat apart from the ordinary lines of activity of the station, but corresponding to an evident need existing along the Mississippi River, there were conducted during a period of years some simple but immediately practical experiments in smoking the common fishes of the Mississippi River which had no particular value in the fresh state and which brought so little return to the fishermen that they were often allowed to go to waste. Some of these were occasionally smoked, but in many cases the smoking was so carelessly or ignorantly done that the product was inferior in taste and in keeping quality. Others were thrown away or sold for nearly nothing. The result of the experiments at Fairport was to enable the Bureau in a period of food emergency to issue a printed circular describing in detail the construction of a simple portable smokehouse, the methods of operation for different fishes, and the qualities of taste imparted to the fish by several sorts of fuel. This was followed almost immediately by sending out demonstration parties along principal rivers and even along the seacoast, proving by actual test, both to fishermen and to housekeepers, that "coarse" or "useless" fishes could be made palatable to the consumer and profitable to the fishermen. This was a simple and practical thing to do, but it required some years of experimental work, as opportunity offered, to try out various fishes by varied methods and to learn some things that were entirely unexpected.

The Fairport station, then, as a special agency of the Bureau of Fisheries, adapts its services within reasonable limits to the varying needs arising within its sphere of action. It endeavors to bring about a broader and better understanding of our inland waters as national resources—that they may be viewed not only as channels of surface-water drainage, as avenues of transportation, or as convenient and economical sewers, but as fields for the continuous production of necessities of food and raiment. It has set before it the task of discovering by scientific study and by practical experiment the conditions of preservation and increase of the useful life of inland waters.

Its work should tend to disclose what degree of protection is necessary and what methods are feasible, what conditions of biological, chemical, and physical environment are favorable for increased production of fish and other aquatic animals, and what measures may be taken to improve the environments in ponds, lakes, and streams.

The objective, let us say, is the prevention of the continued depletion of our aquatic resources, and the bringing of all interior waters to a condition of greatest fruitfulness. The way may be long and beset with obstacles, and success can be attained but gradually and by means of persistent effort and painstaking study. As we have indicated, some small milestones of progress have been passed, but it must be evident to all that the main task is for the future and that it is big enough and sufficiently complex and offers a degree of promise not only to justify the best efforts of the station, but to enlist the cooperation of all those having opportunity and interest to render public service through attention to the resources of interior waters.

PROGRESS IN BIOLOGICAL INQUIRIES

REPORT OF THE
DIVISION OF SCIENTIFIC INQUIRY FOR
THE FISCAL YEAR 1920

By R. E. Coker
Assistant in Charge

Appendix II to the Report of the U. S. Commissioner of Fisheries for 1920

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PROGRESS IN BIOLOGICAL INQUIRIES.

REPORT OF THE DIVISION OF SCIENTIFIC INQUIRY FOR THE FISCAL YEAR 1920.

By R. E. Coker,
Assistant in Charge.

INTRODUCTION.

There are times when it is worth while to inquire somewhat searchingly into the value of the varied activities of the Federal Government, to ask what good purposes are to be served through a particular governmental function. Clearly, such a time is upon us now, and it is appropriate, therefore, to prefix this report of progress with a brief statement suggestive of the purposes which the Bureau of Fisheries attempts to serve through the Division of Scientific Inquiry.

The direct and practical relation of scientific studies to the fishery industries is not always clearly understood. A successful industrial establishment depends no less upon the maintenance of the source of supply than upon the marketing of its product. The Division of Scientific Inquiry stands with reference to the fishery industries somewhat in the same relation as the supply department to a manufacturing concern: It does not produce the raw materials,[a] but it concerns itself with the problems of ultimate sources, of judicious exploitation, and of the means and conditions of maintenance or possible increase of supplies.

To be more concrete, an oyster industry is impossible without oysters, but it is now painfully evident to all concerned that, in northern waters at least, the continuance of a supply of oysters depends upon the solution of problems of scientific inquiry, the problem, for example, of the conditions of securing a set. The salmon industry ranks among the very first in the fisheries of the United States, yet in most waters we have witnessed a gradual decline in the abundance of salmon, and where such a decline is not manifest, as in the Columbia River, it is universally attributed to the measures of artificial propagation. The Bureau is therefore urged to investigate the conditions of success in maintaining the desired runs by artificial propagation, and to furnish that knowledge of the life history and migrations of salmon without which they can not be successfully protected and conserved. These are problems of scientific inquiry. The stock of whitefishes in the Great Lakes has been gradually depleted, but protective measures can not be most intelligently devised and enforced without knowledge of the life history, habits, and movements of the fish, and this can be gained only by the skillful application of the methods of science. Nearly all persons concerned in the great shrimp fisheries recently developed off the South Atlantic and Gulf Coasts view with concern the future maintenance of the supply. Can the shrimp be wisely protected or most judiciously exploited while we do not know when or where it breeds or why it appears here or there in greater or lesser abundance? Clearly scientific studies have a very practical relation to the perpetuation of such a fishery.

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[a] That in this case is a function of nature as assisted by fish-cultural operations.

Beyond a doubt, there is no one connected with the fishing industries who believes, with reference to the majority of the existing fisheries, that any of them will maintain its present importance in future time, except as the resources upon which it is based may be conserved by sensible measures of protection. And certainly no one concerned with the determination of protective measures would hesitate to say that we must know the fish (or shellfish) and its manner and conditions of life if we would successfully protect it.

It is, then, of direct and not indirect importance, of practical and not theoretical significance to the fisheries that we should study the fish and attempt to solve some of the many problems upon which depend the perpetuation of the resources and the development of the industries. The industries are founded absolutely upon the resources. The maintenance of the resources is conditioned upon the results of scientific inquiry. How shall depletion be prevented? To what extent can utilization be carried? What are the possibilities of propagation, the conditions, the results? What are the methods and conditions of protection? How can the natural environment be improved? How can disease be combated or unfavorable conditions of environment be changed? It is such questions as these that scientific inquiry must answer. The very statement of the purposes to be served renders unnecessary the presentation of argument for their pursuit. The merit of the service performed can best be determined from the report of its progress that follows, allowing, as one must, for the varied geographic and industrial interests to be served.

The Bureau does not, of course, fulfill all of its functions in scientific inquiry at any given time, but this report will serve to indicate the present scope of work, as well as the progress that is being made. It may be remarked finally that the activities of the fiscal year just closed were reduced as compared with that of previous years, and that further reduction will mark the year next to come, due to the loss in course of the last year of not a few of the men who contributed to the accomplishment of the year's work. What has been done is due to the loyal and efficient services of men who have labored without stint under conditions of discouragement. Acknowledgment is due no less to those who have left only under the impulsion of circumstances than to those who have found it possible to continue in service.

STUDIES OF FISHES.

ANATOMY OF THE SALMONS IN RELATION TO FISH CULTURE.

From time to time the Bureau has had reports of abnormal conditions of brood fish at its trout stations, such as the sterility of brood fish which have been used for several years. These conditions do not keep the hatcheries from having success in propagating fish, but they do make the output less and the cost more. They involve waste, and it will pay, therefore, to find and remove the cause. It has always been supposed and was seemingly established by published descriptions that the eggs of salmonidæ are passed into the abdominal cavity and thence discharged. Recently Dr. W. C. Kendall, scientific assistant, as the result of anatomical researches, discovered that the published descriptions were wrong as referring to the several species which have come under observation. He has found that the membrane by which the ovary is suspended enfolds it in such a manner that the mature eggs do not normally fall into the abdominal cavity but pass along a sort of trough formed by a continuation of the suspending and enfolding membrane of each ovary, which extends to a point not far from the outlet, where the two unite into a single trough attached to the upper surface of the intestine. It is also apparent from the conditions discovered that eggs which escape into the body cavity could not in any conceivably normal way be subsequently discharged. The escape of eggs into the abdominal chamber is then abnormal, and the common observation of eggs in this space may be presumed to result from the improper handling of fish in artificial spawning operations or in preparation for dissection.

It was suspected that the bad condition of brood trout at some fish-cultural stations may have been due to rough or careless handling during spawn taking. Examination of specimens sent in from several stations strengthened this suspicion. Dr. Kendall then proceeded to visit a fish-cultural station, observe carefully the operations of spawn taking, and make immediate examinations of the fish. The results of the observations made at one of the best stations, taken in connection with the studies just mentioned, indicate that the abnormal conditions referred to were probably due, not so much to careless spawn takers as to wrong practices. Improvements in method are required, though additional thought and study seem necessary before explicit directions can be given.

ATLANTIC SMELTS.

Dr. W. C. Kendall, with the aid of D. R. Crawford, is completing a monograph of the species of the smelts (Osmerus) of the Atlantic coast of North America. The smelts are abundant and widely distributed fish of small size, which are of value not only in the markets, but also in the water as a source of food for game and food fish of larger size. The studies pertain to the geographical distribution, life history, growth, habits, habitats, and importance, and to the conditions of conservation both of the marine and the fresh-water smelts. Particular attention is given to those of New England and to the "ice fish" of Lake Champlain. There are indications of local races of marine smelts, and some fresh waters appear to be inhabited each by a race or species, distinct not only from the marine smelt but also from smelts of other fresh waters. The variation in size attained in some of the fresh waters of Maine is remarkable. Some lakes are inhabited by two distinct sizes of mature smelts, each having well-defined breeding seasons and subsisting upon different kinds of food. In one lake the minimum size of the small smelt when mature is about 1½ inches and the maximum size of the large smelt 4 inches, while in another the minimum size of the small form at maturity is about 4 inches and the maximum size of the large form 15¾ inches. We have to do, it seems, either with different species or with distinct races; that is to be determined later.

DETERMINATION OF SPECIES AND RELATIONSHIPS IN THE SALMON FAMILY.

One of the obstacles to the best success in fish-cultural work is the great difficulty of distinguishing positively the species of trouts and salmon. To obtain the desired results in propagation and distribution of fish, it is necessary to know beyond a doubt what species is being propagated and planted, as well as what kinds are native to certain waters, and what have previously been introduced. Nevertheless there still exist among sportsmen, fish-culturists, and scientists varying and conflicting opinions regarding the identity and relationships of the species of Salmonidæ, notably in the case of the steelhead and rainbow, fish which are extensively propagated by Federal and State hatcheries.

The difficulty lies solely in the fact that sufficient technical work has not been done upon the structural examination and comparison of such fish in numbers and from varying localities. The bureau has, therefore, encouraged the prosecution of a thorough and critical study of the structure and relationships of the members of the important salmon family.

Dr. W. C. Kendall, scientific assistant and ichthyologist, has given much attention to the osteology (bony structure) of salmon, trout, and related fishes, which, with studies of scales, proves of much value in the determination of families, genera, and species. While verifying many of the statements of others, some new facts have been discovered.[a]

A paper which is in preparation, based upon a study of trout from various regions of the West and upon geological considerations, presents a scheme of origin and distribution of the trouts which offers a plausible explanation of their present distribution and throws light upon hitherto obscure problems of classification.

Another report nearing completion is believed to settle the much-discussed question of the specific identity or distinctness of the rainbow and steelhead trouts.[b]

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[a] It appears that the salmons, trouts, and chars form a family (Salmonidæ) distinct from the whitefishes and ciscoes (Coregonidæ), the latter being based upon the characters enunciated by Cope and given by later writers as the characters of a subfamily. It has not yet been decided whether or not the grayling should be regarded as a family (Thymallidæ, Gill) distinct from the whitefishes (Coregonidæ), in which Regan includes them. The separation of the Pacific coast salmons (Oncorhynchus) from the genus which embraces the Atlantic salmon and rainbow and steelhead trouts is definitely confirmed. The lake trout (Cristivomer) is found to be notably different from the brook trout (Salvelinus). The smelt family (Osmeridæ, Regan) should also stand as distinct from the Argentinidæ. The pelvic bones of *Argentina silus* are widely different from any other isospondylous fish examined.

[b] After a careful study of the fish from taxonomical, anatomical, and distributional evidence the conclusion is reached that there are at least two wild forms which have been confused under the names of rainbow and steelhead trouts. One is predominantly migratory (ascending fresh waters from the sea), the other predominantly a permanent fresh-water inhabitant. The name *Salmo irideus* was originally bestowed upon a small steelhead form, as was also *Salmo rivularis*. There is absolutely no doubt concerning the proper application of *Salmo gairdnerii* to the steelhead, as Richardson's description is that of a large Columbia River fish and not a small blueback salmon (*Oncorhynchus nerka*), as one writer has stated. Contrary to current descriptions, the steelhead has

THE WHITEFISHES AND THEIR RELATIVES.

For a long time the Bureau, the several State fishery authorities concerned, and the trade have felt the serious need of knowledge regarding the habits of the whitefishes, ciscoes, and so-called lake herrings of the Great Lakes. Yet up to the present time we have not had even that positive determination of the species which is an essential basis of an inquiry into migrations, propagation, and other habits. During the past two or three years Dr. Walter Koelz, general assistant, has been detailed to a comprehensive study of the whitefishes and their relatives in the Great Lakes, beginning in Lake Huron. During the past year he completed the field work and report based upon that lake.

His report, which represents a substantial advance in knowledge of these fishes, is based upon a collection of 3,000 specimens of Lake Huron Coregonines and on field data as to their breeding times and breeding places, geographic and depth distribution, and migrations. He has definitely distinguished and defined 10 forms—8 species and 2 subspecies—all of which are referred to the Linnaean genus *Coregonus*. Two new species are described and three subgenera are recognized (*Leucichthys*, *Coregonus*, *Prosopium*). The forms of one subgenus (Leucichthys) fall into two ecological groups: (1) the lake herrings (*artedi*, *manitoulinus*), and (2) the chubs (*alpenae*, *reighardi*, *johannae*, *nigripinnis*) and bloaters (*hoyi* and its variant *profundus*).

The lake herrings are taken in shallow water to a depth of 16 fathoms, rarely deeper. One of them (*artedi*) is known also to range the surface waters to a considerable distance from shore. They spawn in November in shallow water on sand and gravel. The chubs and bloaters are taken near the bottom in water 30 to 80 fathoms or deeper. They occur on mud or clay bottom and feed chiefly on species of crustacea and mollusca. The spawning season for the five species extends from late August to March.

The species of chubs and bloaters have definable but overlapping ranges as regards depth. Each form has its greatest density of population at the center of its bathymetric range, and this density diminishes toward the borders of its range.

The pilot, *Coregonus* (*Prosopium*) *quadrilateralis*, occurs usually along the shores to a depth of 20 fathoms. It breeds in November in shallow water on rock or gravel bottom. The whitefish, *Coregonus clupeiformis*, is also shore-loving, seldom occurring deeper than 20 fathoms. It spawns in November in shallow water on rock or gravel. It is not expected that the report will be offered for publication before the investigations in other lakes are completed.

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larger (fewer) scales than the rainbow, and there appear to be other though inconspicuous and concealed structural differences.

There is probably more than one species or race of rainbow trout, and possibly also of steelhead. However, the rainbow trout of fish culture is largely from McCloud River (Calif.) stock and should bear the name, not *Salmo irideus*, but *Salmo shasta*. The fish-cultural rainbow stock has been more or less affected by admixture of another form principally from Klamath River, which may be another form or species of rainbow or perhaps a steelhead. This admixture is clearly perceived in the appearance and structure of many specimens of the rainbow stock of some of the hatcheries. The steelhead stock has always, so far as known, been unadulterated *Salmo gairdnerii*, although in the distribution from hatcheries it is known that in some instances the two forms have been regarded as identical and distributed as rainbow trout. Pure *Salmo shasta* is distinguished from pure *Salmo gairdnerii* by the smaller scales of the former.

BIOLOGY OF THE PACIFIC SALMONS.

The salmon fisheries, very valuable in themselves, support a packing industry, the product of which is of still greater value. Speaking in terms of appropriate correctness, we may say that the salmon taken from the rivers and lakes of Pacific Coast States and Alaska now yield each year 6 pounds of highly nutritious meat food for each man, woman, and child in the United States and its possessions. We enjoy and esteem these valuable economic resources now, but it is a serious question if the generations to follow will derive like benefits from the same waters.

It is true that the salmon are not necessarily exhaustible like a mineral resource, but that they are by nature self-perpetuative, provided only that present and future utilization is rightly regulated and that artificial propagation is intelligently directed. The decline of the fishery in most of the waters of the Pacific coast is clear evidence that we are not yet properly meeting the requirements in propagation and regulation. The situation in Alaska waters, a relatively new field of exploitation, has already reached a stage which investigators assure us is critical and which may be but the beginning of an era of decline.

It becomes a high responsibility, then, that we find out what must be done, that we study the salmons until we know fully their life histories and habits and the conditions of the maintenance of the runs.

The investigations conducted by Prof. C. H. Gilbert and Mr. Henry O'Malley in Bristol Bay and other Alaska waters, through cooperation of the Divisions of Scientific Inquiry, Fish Culture, and Alaska Fisheries, are reported fully in "Alaska Fisheries and Fur Industries in 1919,"[a] and need not, therefore, be described in this connection.

In Pacific Coast States studies of salmon have been conducted primarily by Willis H. Rich, with particular attention to the life history of the chinook salmon of the Columbia River.

Considerable progress has been made in the study of the life history as based on scale analysis. The necessary foundation for this work was laid by studies conducted during previous years and published recently under the title, "The Early History and Seaward Migration of the Chinook Salmon in the Columbia and Sacramento Rivers."[b] Even with the data at hand, the accurate interpretation of the adult scales has proven an extremely difficult task, owing to the great diversity in the types of nuclear growth. As a result of the study of large series of scale photographs and the calculations of sizes at various ages of several hundred individuals, it has now become possible to interpret fairly accurately the age and early history from examination of the scales of adult fish. From investigations pursued in the various tributaries of the Columbia River, it is found that many contain distinguishable races, just as had previously been shown in the case of the sockeye. The study of the chinook salmon taken in the open ocean by trollers and purse seiners has progressed to the point where a preliminary report is in course of preparation.

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[a] Bower, Ward T.: Alaska Fisheries and Fur Industries in 1919. Appendix IX, Report, U. S. Commissioner of Fisheries, 1919. Washington, 1920.

[b] Rich, Willis H.: Early History and Seaward Migration of Chinook Salmon in the Columbia and Sacramento Rivers. Bulletin, U. S. Bureau of Fisheries, Vol. XXXVII, 1919–20, pp. 1–73. Washington, 1920.

Satisfactory returns are being obtained this year from one of the experiments in marking young chinook salmon at the hatcheries of the Columbia River. Some returns have been obtained from three other experiments, and it is possible that additional results may be obtained later this year.

Additional marking experiments have been started during the past year with particular reference to chinook fry and yearlings and yearling sockeyes. At the same time, and in cooperation with the State Fish and Game Commission of Oregon, a representative of the Bureau began last spring the tagging of adult steelhead in the Rogue River. A proposed study of the steelhead and chinooks in this stream has, for various reasons, been delayed.

HABITS OF FRESH-WATER FISHES.

Perhaps no papers published by the Bureau are of more service to fish culture, to angling, and to the utilization and conservation of fresh-water fishes than those which comprise the results of careful studies into the habits of useful fishes. The works of Dr. W. C. Kendall, Dr. A. S. Pearse, and Dr. Jacob Reighard fall naturally into this class. Recent studies by Dr. Kendall are referred to in another place. The results of Dr. Reighard's observations are to be given publication in other places.

Some results of Dr. Pearse's recent studies are embodied in two useful reports, of which one was published last year and the other of which is in press. They are entitled, respectively, "Habits of the Black Crappie in Inland Lakes of Wisconsin"[a] and "Habits of Yellow Perch in Wisconsin Lakes."[b] The observations, which have been extended to several lakes, are based upon numerous collections at various seasons, places, and depths, the tagging and recovery of individual fishes, studies of food and parasites, and various other considerations.

BREEDING HABITS OF THE PADDLEFISH.

During a considerable portion of the past two years Dr. A. D. Howard, field assistant, has conducted an inquiry into the breeding habits of the paddlefish, *Polyodon spathula*, a food fish of the Mississippi Basin, which attains a large size and which is of particular value because its eggs make a grade of caviar scarcely inferior to that of the sturgeon. This important fish is diminishing in numbers, but all attempts at artificial propagation and all previous investigations of the breeding habits of the species have been barren of practical results. The present investigation, which began in January, 1919, was made possible through the cooperation of the Conservation Department of Louisiana.

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[a] Pearse, A. S.: Habits of the Black Crappie in Inland Lakes of Wisconsin. Appendix III, Report, U. S. Commissioner of Fisheries, 1918, 16 pp. Washington, 1919.

[b] Pearse, A. S., and Henrietta Achtenberg: Habits of Yellow Perch in Wisconsin Lakes. Bulletin, U. S. Bureau of Fisheries, Vol. XXXVI, 1917–18, pp. 293–366. Washington, 1920.

Observations were first undertaken in White Lake, near the Gulf, where the Superintendent of Fisheries had previously conducted investigations of the spawning of paddlefish. Owing, however, to changes having occurred in the lake due, it was believed, in part to drought and removal of water from the lake for irrigation of rice fields and in part to overfishing, no paddlefish were obtained. The investigator then proceeded to Natchitoches and Red River Parishes, where better conditions were encountered both in the Red River and in the Oxbow Lakes adjacent to it. Here over 300 paddlefish were taken, of which 17 were mature females with eggs and 3 were mature males. No females with eggs free or running were found, but one spent female was taken April 2 and another April 11.

An experiment was made in retaining large paddlefish in a good-sized inclosure formed by placing fine-meshed wire netting across the mouth of an arm of a bayou. Although no results in propagation were obtained, it was demonstrated that paddlefish could be kept in such an inclosure for two or three months at least. It was found also that by tethering a paddlefish by a line 5 or 6 feet long to an empty gallon jug the fish could be kept in good condition and recovered at will.

It was observed that while large mature fish may be found in isolated lakes, young paddlefish are found only in those lakes or bayous which have a connection with the river. Nevertheless, it may be that paddlefish propagate successfully in isolated lakes of very large size, such as White Lake (in former years), where the chance of avoiding enemies is better. Fish retained in small pens or tied with a line were frequently attacked and killed by turtles, principally the soft-shell turtles. The turtle evidently sought the eggs, since this was the first part of the fish to be devoured, and turtles taken in the vicinity were observed with paddlefish eggs in mouths and stomachs.

In the spring of 1920 more attention was given to river fish than to those landlocked in lakes, but on account of flood conditions only a very small number were secured and none of these were mature males. While awaiting more favorable conditions, experiments were continued upon the lake fish, the eggs being treated by the artificial fecundation method successfully used with sturgeon. Eggs in sand remained free of fungus, but no development was observed in any of them. It is believed that success depends upon securing river fish (among which only have spent females been found), but a favorable season without too much high water is necessary for this.

LIFE HISTORIES OF MARINE FISHES.

One of the most important conditions of intelligent exploitation or protection of the great fisheries of the seas is a knowledge of the life histories of the species. Such knowledge is difficult to obtain, since it is manifestly impossible to observe directly the daily and seasonal movements of individual fish that possess the freedom of the sea. The desired knowledge can be accumulated but slowly through the pursuit of oceanographic studies and the continual collection of fishes under conditions of accurate record, with especial reference to eggs and larvæ. The material and the data accumulated at any one time may tell no useful story, but when there has been gradually gathered together a great store of materials, many of the several elements will be found to fall into series; a patchwork quilt is eventually formed which depicts in accurate form and in more or less complete detail the interesting and long-desired story of the migration and feeding and breeding habits of one or more species of fish. The studies of life histories of fishes of the sea are, therefore, linked with the oceanographic studies to receive brief reference in another place. W. W. Welsh, scientific assistant, has been engaged in the study and identification of the large collections of larval fishes now in the Bureau's possession. Collections were also made while he was engaged upon the *Albatross*, and just before the fiscal year closed his field studies were extended to a point on the New Jersey coast offering unusual facilities for the daily observation of fishes taken alongshore, for experiments in the hatching of such eggs as might be obtained, and for rearing the larval fishes to an advanced stage. Mr. Welsh has devised an ingenious automatic apparatus for holding pelagic fish eggs during incubation so that their development may be studied.

SARDINE OF NORTHWEST COAST.

A further inquiry into the occurrence of the pilchard or sardine, *Sardinia cærulea*, off the coasts of Washington and Oregon was conducted during the past summer by C. L. Anderson, assistant in the Bureau. Observations and inquiries were made near the mouths of the Columbia, Siuslaw, Umpqua, and Coquille Rivers, and at Yaquina, Alsea, and Coos Bays. It is reported that some sardines enter the inside waters every summer, but that the run is extremely variable as to abundance. Mr. Anderson suggests that the presence of sardines in the bays is largely controlled by the proportion of fresh water brought into the bays by the rivers, the run being light or wanting when the salinity of the bay water is lowered. Practically none entered these bays during the past summer. While sardines may be present in the ocean beyond the bars at practically all times, as evidenced by statements of trollers and halibut fishermen and by study of the stomach contents of troll-caught salmon, yet the nature of the bars over which access to the harbors must be had and the severity of weather conditions would make it difficult to operate a regular sardine fishery. The evidence now in hand is not favorable to the establishment of an important sardine-packing industry in Northwest States.

FISHES IN RELATION TO PUBLIC HEALTH.

It is doubtful if any function of the Bureau is worthy of higher public esteem than one which brings it into direct relation with improvement of the conditions of public health and makes it an effective and indispensable servant in the progressive elimination of a disease that not only produces vast economic losses by disability of laborers and employers, but year by year robs thousands of men, women, and children of energy, ambition, and happiness. The investigations of previous years not only bore abundant fruit when the Bureau could render a substantial service during war times in the protection of the health of soldiers in cantonments, but they have placed the Bureau in position to play an active and continuing part in the extensive antimalarial campaign in Southern States.

PARTICIPATION IN ANTIMALARIAL CAMPAIGN.

Responding to a request from the Surgeon General of the United States Public Health Service, Scientific Assistant S. F. Hildebrand was detailed in February to cooperate with that Service in making inspections in the Southern States and in conferring and advising with the various public health officers, Federal, State, and municipal, in the use of minnows for the destruction of the immature mosquito. As the work was extended to various points in 12 States, it was found that public health officers generally, when properly acquainted with the conditions of success of mosquito control by the use of fish, were glad to make use of a method which in many cases was both practicable and inexpensive. Many favorable reports, showing considerable savings accomplished by the use of fish under favorable conditions, have been given by sanitary engineers and others. As compared with control by oiling, the elimination of mosquitoes by the use of minnows is not only inexpensive but also relatively enduring in effect, if the bodies of water are permanent.

There appears at this time to be no other mode of mosquito control inexpensive enough to be widely applicable in rural communities where measures of drainage and oiling could be employed only at a per capita cost that renders them impracticable. The principal fish used is the common southern top minnow (*Gambusia affinis*), although the star-headed minnows (*Fundulus notatus* and *Fundulus nottii*) are being used to a limited extent. Many observations in various localities give positive demonstration of the effectiveness of Gambusia in eradication of mosquito breeding under appropriate conditions.

It is not to be inferred that mosquito control by fish is attained automatically; rather is the exercise of intelligence, knowledge, and care essential for success. It must be borne in mind, too, that as yet there have been discovered only some of the conditions of successful control. Much remains to be learned by repeated observations and experiments before the broadest use of fish as an agency for the prevention of malaria will be possible. Therefore advice and demonstration of what is now known must not be allowed to displace the plans for further investigational work. The same assistant will continue to prosecute investigations and extend practical services with particular reference to the conditions in Southern States.

FISH AND MOSQUITO STUDIES AT MOUND, LA.

Previous reports have mentioned the cooperative investigations which were being pursued with the Bureau of Entomology at the field laboratory of that Bureau at Mound, La., R. L. Barney being the Bureau's resident agent in charge. The observational and experimental work at that station was brought to a close about the middle of the fiscal year in order that the accumulated data might be compiled and a report prepared. Reports on certain phases of this investigation have been prepared, but the completion of a final report has been delayed by the loss of an assistant and by the unavoidable exactions of other duties.

MOSQUITO CONTROL IN NORTHERN WATERS.

While malaria is not prevalent in Northern States, the mosquito problem persists and exerts its ill effect upon property values, industrial productiveness, and personal efficiency. This was well illustrated when large sums of money were expended in the effort to exterminate mosquitoes in the vicinity of a large shipyard.

Prof. J. Percy Moore, of the University of Pennsylvania, as a temporary investigator for the Bureau, has been charged with certain experiments conducted in the vicinity of Philadelphia. He has also participated in investigations in the Palisades Interstate Park with reference to the control of mosquitos by the use of fish and other aquatic animals. A very gratifying degree of cooperation is extended by the officials of the park, and experiments have been started which are producing results of scientific and practical interest. Improvement of the shore conditions around one of the principal ponds of the park has already resulted in giving small fish better access to shallow coves and little cut-off pools, and this in turn has effected a material reduction in the abundance of mosquito larvæ. Subsequent examinations of the stomachs of young fishes admitted to such waters formerly teeming with mosquito larvæ have shown a large proportion of mosquito eggs, larvæ, or pupæ in the food. Other experiments are in progress.

This work is being done in connection with the cooperative investigation between the Bureau of Fisheries and the New York State College of Forestry at Syracuse, having to do with the control of mosquitoes, the elimination of blood-sucking leeches, and the development of the fish-cultural possibilities of the park. The general object is to promote favorable conditions in the park for fishing, bathing, and other forms of recreation.

EXPERIMENTAL FISH CULTURE.

Previous reports have stressed the need for fish-cultural experiment work; yet this field of endeavor remains in a condition of development that offers relatively small promise until circumstances may be changed. This is not for lack of possibilities of service to Government, State, and private fish culture, or for deficiency in facilities; the opportunity is there, but the special personnel is wanting. Fish-cultural work demands the service of specialists—those who can study systematically and continuously the functions and relations of plants, insects, crustacea, bottom conditions, fertility, form and depth of pond, etc., with reference to methods of fish culture and the productiveness of fishponds. The most the Bureau has been able to do during the year just closed has been to keep the flame of experimental fish culture burning, with the hope that provision may yet be made for its adequate conduct.

Some further results of importance have been gained in the experiments conducted at the Fisheries Biological Station, Fairport, Iowa, with catfish, buffalofish, bass, and sunfishes. Certain experiments are under way to determine the value of the use of manure or commercial fertilizers for increasing the fertility and productiveness of fishponds. Prof. C. B. Wilson at that station also continued his investigations of aquatic insects in relation to fish culture in ponds. There are shortly to be published two papers by this author on the life history and fish-cultural significance of some of the insects most commonly present in fishponds.

A paper consisting largely of compilation and analysis of published European and American data concerning the culture of fresh-water crustaceans ("shrimp," etc.) as food for fishes in hatcheries and in ponds was completed during the year by Dr. W. C. Kendall and submitted for publication. It is believed that the culture of some kinds of crustacea as food for fish would be economically feasible under certain conditions, depending much upon locality and the immediate surroundings of a particular fish-cultural plant.

A service of no little importance was rendered when Dr. Emmeline Moore, who has conducted several investigations for the Bureau, was detailed to visit some of the fish-cultural stations and advise with superintendents regarding the best use of plants in fishponds. Against what might have been assumed to be obvious handicaps, the advice of this investigator quickly established itself in the confidence and esteem of practical fish-culturists. Her work commanded such attention that her services were drafted by a State Government which could offer more favorable conditions of employment than this Bureau.

The greatest need in the fish-cultural experiment work of the Bureau is continuity and the application of persistence, skill, and judgment, and this need can be met only by the making of the special provision of personnel which the conditions may be found to warrant.

STUDIES OF DISEASES OF FISH.

Closely related to fish-cultural experimental work is the study of the diseases of fish and the conditions which occasion mortality or diminished vitality of fishes. The parasites of fishes also demand attention, not only because of their unfavorable effect upon the vitality of the fish but because the presence of parasites, even such as are not injurious, renders fish less attractive to the consumer and accordingly diminishes the market value of the fish. Diseases of fish are of real concern from an economic point of view, not only for the resulting direct losses to food supply but for the mortality of eggs, fry, or fingerling in hatcheries, which causes serious losses in efficiency and entails a substantial loss of public funds expended in fish-cultural operations. As a matter of fact, fish pathology is a broad subject, for the studies of pathological and other unfavorable conditions throw light upon the various fish-cultural practices and especially upon the propriety of use and the value of the several sorts of foods employed in artificial feeding.

The routine work of the fish pathologist, Dr. Franz Schrader, included investigation into reports of fish mortalities in various parts of the country, examination of specimens sent to the Bureau for the determination of the cause of disease or death, and trips to the stations in connection with epidemics among fish or unsatisfactory conditions among fry.

An analysis of the so-called white-spot disease in fish eggs has been virtually completed. It is apparent that the ordinary occurrence of this disease finds its cause in careless handling of the eggs, be it in the course of stripping or during transportation. Bacterial agency is not primarily responsible in causing white spot as it is commonly seen during hatching operations, and European observers who have reported it seem to have had exceptional cases. Mention may be made of a still different form of the disease in Alaska, of which only superficial investigation has been made.

Work was started on the study of ovarial conditions in various fishes, especially at time of spawning. It is this phase in the various activities of fishes which bears directly on the problems of sterility, production of "glassy" ova, hardening of ovaries when retained in pens or crates, and effect of stripping. The nature of the problem makes the work on it more or less sporadic.

The troublesome question of the great mortality in hatching pike-perch eggs is under investigation at present. A visit was made to Swanton, Vt., at the time of spawning, to observe conditions in the field. In spite of the fact that the problem is an old one, it seems that no definite analysis of the morphological features of affected eggs has ever been made. Consequently the few remedial measures employed have been of little or no advantage. The essential studies are now in progress.

FISH DISEASE IN ST. LAWRENCE RIVER.

While mortality of fish in natural waters as a result of disease is not usually conspicuous, nevertheless there are occasions when such occurrences demand attention. An investigation of an epidemic among the fish in the St. Lawrence River at Ogdensburg, N. Y., was made during the first week in July, by Prof. H. S. Davis, temporary investigator. The superintendent of a New York fish hatchery had reported that large numbers of fish were dying in the ponds and also in the river.

The epidemic was at its height during the first two weeks in June and then decreased rapidly in severity. At the time of the investigation the disease had entirely disappeared from the ponds and only a few diseased fish were taken in the river. None of these appeared to be seriously affected.

The fish taken in the river showed two distinct types of lesions on the skin. On the bullheads and catfish the infected areas were very distinct, about one-half to 1 inch in diameter and bright red in color, due to the complete destruction of the epidermis, thus exposing the inflamed dermis beneath.

The diseased areas in the skin of bass and suckers had a very different appearance. They were irregular in shape and so indistinct as to attract attention only on close examination. The most marked characteristic was a faint reddish border around the scales, due to a slight extravasation of blood into the epidermis.

A microscopic examination of sections of skin from the infected areas indicates that the disease in bullheads and catfish is probably distinct from that in the bass and suckers. In the former the disease is apparently due to bacteria, which are present in enormous numbers in the disintegrating epidermis. These bacteria are not present in the lesions on bass and suckers, and the cause of this affection is at present problematic. A further report may be made.

LINSEED MEAL A CAUSE OF TROUT DISEASE.

Some time ago a peculiar disease appeared at a commercial trout hatchery in Rhode Island among yearling and 2-year-old brook trout. The fish turned black, many became blind, and large numbers died. Just previous to death an affected fish would dart rapidly about, sometimes jumping entirely out of the water. After swimming nervously in this way for a few seconds, the fish would usually turn partly on its side, remain quiescent for an instant, and then resume its former unnaturally sluggish swimming. In most cases the fish would repeat this performance several times before finally succumbing.

Dr. L. H. Almy, then fish pathologist in this Bureau, was detailed to an investigation of the trouble. It was learned that the disease had manifested itself a few weeks after the superintendent had begun feeding with a mixture of linseed meal, wheat middlings, and meat scraps, the linseed meal having been substituted for cottonseed meal previously used. When the meat scrap, with flour and salt, was used without the linseed meal, the disease was definitely checked in both adult fish and fry. Experiments planned by the fish pathologist were then undertaken at the same hatchery to ascertain which, if either, of the two meals had brought on the disease. The results, which were but recently completed for publication, proved that linseed meal was responsible for the pigment change, blindness, and death; that linseed oil in the food of trout has a slightly injurious effect; and that fish affected with linseed-meal poisoning can be brought back to a healthy condition, except for the pigment change and blindness, by a diet of some fresh-meat product.

Further experiments conducted at the White Sulphur Springs (W. Va.) hatchery of the Bureau, with the cooperation of Supt. R. K. Robinson, gave clear evidence that the pigment change, excitability, and weakened eyesight or blindness were due primarily to the prussic-acid constituent of linseed meal. The experiments indicated also that a food mixture consisting of wheat middlings and meat meal, although not injurious and apparently an acceptable food for the fish, does not compare with fresh hog lungs as a food for yearling trout.

SERIOUS DISEASE OF BUFFALOFISH.

A new bacterial disease of fresh-water fishes has been under investigation during the last two summers by Prof. H. S. Davis, temporary investigator. This disease seems to attack nearly all species of fresh-water fishes, but is especially destructive to the buffalofishes, crappies, and bluegills. It is preeminently a warm-weather disease and is apparently of little importance during the colder seasons of the year.

The disease is caused by an undescribed species of bacterium which develops only on the surface of the body and on the gills. On the body it destroys the skin, but never penetrates into the underlying muscles, while on the gills it destroys all the soft tissues. In either case the fish usually succumb within 48 to 72 hours after the appearance of the disease.

The disease does not ordinarily attack healthy or uninjured fish, but even a slight injury or the lowering of the vitality in any way renders the fish susceptible to infection. Fish are especially liable to contract the disease within a day or two after being handled.

It has been found that the disease can ordinarily be controlled by treating the fish after they have been handled with a 1 to 1000 solution of copper sulphate for two to three minutes. When properly used it has been found possible to reduce the loss from this disease from about 50 per cent to 5 per cent or less.

Studies on protozoan parasites of fishes have been continued and a paper is nearly ready for publication describing the development of the cysts and the formation of spores in a species of Myxobolus which is abundant on the gills of the buffalofishes. The early development of the myxosporidian cysts has not previously been worked out. It has been found that the young parasites reach the gills in the blood stream and become permanently fixed in the capillaries of the gills, where they develop into large, saclike cysts, which may cause considerable injury to the gills. The results of studies on several other species of myxosporidian parasites, several of them new, are also nearly ready for publication.

BLACK-SPOT DISEASE OF THE BULLHEAD.

A conspicuous and unsightly disease of the common bullhead or hornpout (*Ameiurus nebulosus*) became very evident in a pond near Falmouth, Mass., in the summer of 1917. The matter having been brought to the attention of the Bureau, and no information regarding a disease of this description being available, Prof. Raymond C. Osburn was engaged as a temporary investigator for a study of the disease.

The disease takes the form of swollen, rough, tumerous, intensely black areas, affecting the skin externally ordinarily, but sometimes entering the mouth cavity and the gill chamber. The subcutaneous tissues are but little affected, the disease being confined almost entirely to the skin, and there is no evidence of spread to other parts of the body. The tumors appear to grow very slowly, but there is evidence that they are infectious, for in 1919 the percentage of infected fish taken in the pond was much greater than in 1917, and nearly all the bullheads taken showed the disease.

Careful study and experimentation proves the disease to be of bacterial origin, the causative organism being a very minute coccus, or bacterium of that general class, probably undescribed. The disease appears to be unknown to science and a widespread inquiry has brought out only the information that no one has ever observed it. The one exception in the literature is found in Thoreau's Journal, where he twice makes mention of observing such black tumors on bullheads in the Concord River and one of its branches.

With the cooperation of Dr. W. W. Browne, bacteriologist, cultures of the bacteria were made on agar mixed with the juices of the fish to produce a proper medium. Though the bacteria grow very slowly, a number of colonies were developed to a diameter of one-eighth of an inch or more in from 12 days to 2 weeks. These had the same intensely black color as the tumors. The color is produced endogenously, and the color of the tumors is due entirely to the mass of black bacteria. In older tumors a slight pressure causes the liberation of an inky black fluid, formed by the bacteria in suspension, and microscopic sections show the presence of the bacteria throughout the substance of the tumor.

Inoculations of unaffected fish from another pond were made in three ways: (1) by subcutaneous injection, (2) by abrading the skin and rubbing in the fluid taken from a tumor, and (3) by grafting portions of the tumor into the skin. Several of these developed and showed some growth in the two months that the fish were kept under observation.

It seems probable that natural infection takes place through abrasions of the skin, as the tumors are usually located on the fins and lips where such abrasions would more naturally occur accidentally. The habits of the bullheads in schooling together render this mode of transfer easy.

As to the fatality of the disease we have no information. Certainly it is not rapidly fatal, for specimens with well developed tumors were kept alive in aquaria in the laboratory for six weeks without showing any appreciable change other than some slight growth in area and thickness of the tumor. It would thus appear that no active systemic poison or toxin is formed by the bacteria. There is, however, a tendency for the tumors to become fungused with *Saprolegnia*, a water mold, which would no doubt cause death in time if the tumor did not. While dead catfish have not been observed about the pond, the shores are such that they would not readily be noticed. No other species of fish in the pond showed any indication of the tumors, and the probability is that the disease is specific for the bullhead.

GENERAL STUDY OF PARASITES OF FISHES.

Systematic studies of the parasites of fishes are important for several reasons. While the presence of some parasites is a normal condition in fishes as well as in domestic animals, such as cattle, sheep, and poultry, they may upon occasion become so numerous as to cause the weakening or death of the animal infected. When not leading to death they may yet so affect the condition or appearance of the fish as to render them unacceptable to the housekeeper, which means the loss of the fish as a possible article of food. In cases of this kind, and they occur not infrequently, one can not approach the question of cause or remedy or give proper advice to the public unless there is a background of knowledge concerning the normal degree of prevalence of different kinds of parasites in the several species of fish. It is economically necessary, then, that observations of parasites should be made systematically and a large body of evidence obtained. Dr. Edwin Linton's studies in recent seasons have covered about 40 species of fish in the region of Woods Hole, Mass. Attention is being devoted now particularly to the round worms (nematodes). The fear has been felt that round worms, which occur on the viscera of certain fish and not normally in the edible parts of the fish, might during storage of the dead fish burrow into the flesh of the fish and thereby become objectionable. The experiments conducted indicate that the worms do not penetrate the flesh or become attached to it in such a way as not to be removable by the ordinary process of washing.

In this connection reference may be made to the studies of the food of young fishes conducted by the same investigator and applying to 18 species of fish of the Woods Hole region.

THE OYSTER.

The eastern oyster supports the most valuable fishery possessed by any country and based upon a single species; but, important as the oyster industry is in contribution to food supply as well as in its part in the economic life of the Nation, its future can be viewed only with keen anxiety. For some years the industry has been manifestly declining. In past times its chief seats have been on the south shores of New England and New York and in the Chesapeake Bay. During a long period the yield of the Chesapeake has gradually fallen away because of the depletion of natural beds and the misfortunes which have attended all attempts to establish a proper legal basis for the development of a great oyster farming industry. In waters of the vicinity of Long Island oyster farming has long been established on a large scale, but in recent years, and because of conditions which are not yet fully understood, there has been a notable failure of the setting of seed. The planting industry now depends to a very considerable extent upon the importation of seed oysters from distant points; and the expense and the uncertainties are such that leases of oyster bottoms are continually being given up, with consequent loss of revenue to States, as well as diminution in the production of a valuable article of food. The problem of the failure of set has therefore become one of great concern to State Governments as well as to the Nation. It is, however, one of great complexity and may well receive the best attention of all concerned.

There are oyster industries in Pacific Coast States which are now of no little importance and which may have much greater significance in future. It is, therefore, a cause for regret that the limitations of personnel and appropriations have prevented the Bureau from giving to these the attention which they merit.

OYSTER INVESTIGATIONS IN LONG ISLAND SOUND.

At the temporary field laboratory at Milford, Conn., Dr. E. P. Churchill and J. S. Gutsell, scientific assistants, continued the investigations relative to the propagation of oysters. R. V. Truitt, temporary assistant in oyster studies, was engaged in that laboratory for a part of the summer, but spent the greater part of the season in a preliminary reconnoissance of the Chesapeake Bay with reference to oyster culture. The conditions prevailing in the vicinity of Milford were in contrast to those in Great South Bay, Long Island, mentioned on another page. Water samples (usually 50 gallons at a time) were collected in various localities from June 16 to September 10, and, although 215 such samples were examined, only 303 oyster larvæ in all were encountered. Four of the samples yielded 250 of these larvæ, 23 other samples gave small numbers (from 1 to 8), and 188 were barren. (In Great South Bay, on the other hand, several thousand larvæ were sometimes found in one sample.) There being no larvæ, there was, of course, no set.

The virtual absence of free-swimming oyster larvæ from the Milford region is believed to be due to the low temperature of the water, which may have prevented either the fertilization of the eggs or the development of those that were fertilized. The larvæ found were all of the smallest sizes. The bottom temperature, where the water was 20 feet or more in depth, registered as high as 70° F. on only one occasion. For the remainder of the time during the usual spawning season of oysters, it ranged from 65 to 69.5° F., being usually about 68. Oysters in this region are found to begin spawning at a temperature between 68 and 70°. It was observed that oysters in the deeper water did not spawn until about the middle of August, the process continuing slowly and in patches over the beds during the rest of the month. Some of the oysters apparently gave out no spawn at all.

While the shallower water of the coves and harbors warmed up earlier than that outside, and the oysters there spawned earlier, the incoming tide was so cold this season as materially to affect the inside waters, and oyster eggs or larvæ carried from the shallow waters doubtless perished in the cold water outside. In any event, and corresponding with the absence of free-swimming larvæ, as noted, no set of oysters was found or reported anywhere in Long Island Sound.

As emphasized in the report covering the season of 1918, the best evidence obtainable indicates that in former years the set was produced in favorable seasons by natural inshore beds of oysters in warm waters where spawning occurred relatively early. All are agreed that such beds are largely exhausted. The result of the Bureau's investigations tends to substantiate the view that the securing of set in commercial quantities on planted beds, even during favorable seasons, is contingent upon the restoration of the natural beds in inshore waters. Acting upon suggestions to this effect previously offered by the Bureau, the State of Connecticut has appropriated $10,000 for building up the spawning beds, and the results of this practical experiment may be awaited with interest.

WATER POLLUTION AS AFFECTING GROWTH AND BREEDING OF OYSTERS.

It is the inshore waters which are most directly affected by pollution from sewage and industrial wastes, but indirectly the pollution may have a still more significant economic effect on offshore beds even though none of the polluting substances actually touch these beds. It must be remembered that oyster larvæ are free-swimming and may be borne by currents for some distances. The beds in deeper waters are not necessarily self-perpetuative, but may well have been reseeded in former times by set arising from larvæ borne in the waters from breeding oysters in shallow waters. Our observations have indicated, first, that successful propagation of oysters in the Long Island region is dependent upon early spawning, which allows time for development to an advanced and resistant stage before cool weather; second, that this in normal years may occur only in the warmer waters; and thirdly, that spawning beds in shallow waters have virtually disappeared, partly in consequence of excessive fishery, but principally because the excessive pollutions have led to the general abandonment of such areas for oyster planting.

Consequently, in approaching the vital problems of the oyster industry of this region it is impossible to escape attack upon the question of pollutions. Here both chemical and biological problems are involved. The analytical chemist ascertains what substances of possible toxic nature are discharged into the waters; the biologist must determine by experiment the effects of such substances upon the existence and growth of oysters and their efficiency in breeding, and must find the precise degree of concentration which is injurious; finally, the engineering chemist must discover how such substances may be either eliminated altogether from effluents or at least kept within the bounds of safety as indicated by the biologist.

Such investigations by analysis and experiment are now being prosecuted by the Bureau of Fisheries in cooperation with the Bureau of Chemistry, and probably something of a more definite and satisfactory nature may be embraced in a subsequent report.

EFFECTS OF LOWERED OXYGEN SUPPLY UPON OYSTERS.

While the investigation of the subject of pollution as affecting oysters is one of some complexity, it is known that one of the most immediate effects of pollution, generally speaking, is the reduction of the oxygen content in water. During the summer of 1919 an investigation was conducted by Dr. P. H. Mitchell, director of the Fisheries Biological Station at Woods Hole, Mass., to determine the effects of lowered oxygen content on the survival of oysters, the work being done in both field and laboratory.

Observations in the field were based upon a series of small plants of oysters in Seekonk River, a tidal estuary at Providence, R. I., and in Providence River, below the mouth of Seekonk River. Determinations of the dissolved oxygen in the water at the locations selected were made at various times and under various tidal and weather conditions. The results indicated a substantial mortality of oysters where the average dissolved oxygen content was 26 per cent of saturation or less and nearly all oysters died within a period of 50 days where the percentage of saturation was less than 12.

Observations in the laboratory were conducted by keeping oysters in small containers furnished with sea water of varying oxygen content and subject to as definite control as possible. The results indicated that the minimum oxygen content of water that will sustain oysters during a period of one month is between 25 and 33 per cent of saturation. Further experiments are planned to determine the effect of lowered oxygen supply upon the propagation of the surviving oysters.

Another series of experiments has substantiated the earlier findings of copper storage as the explanation of the appearance of a bluish-green color, and recent results point to a possible significant relation between the development of the undesirable blue-green spots and the deprivation of oxygen.

OYSTER INVESTIGATIONS IN GREAT SOUTH BAY.

Dr. Churchill and Mr. Gutsell completed a report upon the spawning of oysters and setting of oyster larvæ in Great South Bay, Long Island. The conditions in this shallow bay offer a contrast to those of the deeper water of Long Island Sound, where low temperatures had prevailed and a failure of set occurred.

In Great South Bay the spawning season extended from about June 5 to July 17, the heaviest spawning occurring July 2 to 6, and the greatest abundance of larvæ being found from July 7 to 11. Spawning began about the time the water temperature reached 70° F., and proceeded briskly while it ranged from 70 to 76°, but slowed down or ceased when the temperature fell to 70 and 68°. When the water temperature rose to 75° and above, about July 2 to 6, the bulk of the spawn was thrown out within the course of two or three days. The approximate length of the free-swimming period was 12 to 14 days. Considerable mortality of the free-swimming larvæ followed a sudden lowering of water temperature or the severe agitation of the water by storms.

The investigation served to throw considerable light on the proper time of planting cultch and the best location of plants for catching a set.

OYSTER INVESTIGATIONS IN LITTLE EGG HARBOR, N. J.

Dr. T. C. Nelson, assistant biologist of the New Jersey Agricultural Experiment Station, completed during 1919 a six months' study of the food and feeding of oysters. While this work, carried on at Edge Cove, Tuckerton, N. J., was primarily State work, yet, since its beginning and continuity were made possible by the cooperation of this Bureau, a summarized account of the results attained is not out of place in this connection.

Studies of the food of oysters were conducted from a floating laboratory anchored directly over the oysters, making it possible to keep a continuous record of the temperature, density, and rate of flow of water, parallel with examination of the food content of oysters.

The results of the microscopic analyses indicate that minute animals may play an important part in the oyster's nutrition. Copepods, nauplius larvæ, ostracods, gastropod and bivalve veligers, round worms, rotifers, and protozoa were found in great numbers. As a typical case, the contents of the stomach of one oyster showed over 4,000 nauplius larvæ and 60 large copepods, besides many protozoans. That these crustaceans are digested was shown by the large number of skeletal parts found in the stomach and intestine.

To study the rate of growth, 1,000 oysters were tagged, weighed, measured, and put out on a fixed platform 1 foot above the bottom. In 130 days these oysters grew in some instances as much as 3 centimeters (1.2 inches), while the increase in weight for oysters 1 and 2 years old was from 40 to 60 per cent. The duration of feeding in the oyster was determined by levers led from the shell of an oyster lying on the bottom to an electrical recording instrument (chimograph) above. The oyster, under natural conditions, continued to feed from 19 to 20 hours out of every 24.

One result of the investigation of the oyster's food has been the demonstration of the large part played by organisms growing on the oyster's shell. On the shell of one oyster 5 inches long were found diatoms in number computed to be over 56,000,000. Oysters covered with external growths may be partly independent of the actual food content of the water flowing over them.

OYSTERS IN VIRGINIA WATERS ENDANGERED BY FUEL OIL.

In the early part of 1919 the escapement of fuel oil upon the waters of Hampton Roads so affected the condition and flavor of planted oysters as to make them unmarketable for a time and to cause substantial financial losses. In the latter part of 1919, in response to reports that fuel oil, presumably discharged from oil tankers, was again threatening the oyster beds in Hampton Roads, the Bureau detailed an assistant to cooperate with the Navy Department in an investigation of the matter. After consultation with the captain of the port and several oyster planters, and after inspection of the water of Hampton Roads, it was found that at that time oil was not being discharged into the waters in sufficient quantities to menace the oysters. Strict orders forbidding the practice had been issued some time previous by the captain of the port, and these were apparently being enforced in such a way as to obviate injury to the oysters.

There have, however, been several subsequent complaints, and, after repeated attempts to render assistance through investigation, the Bureau found it advisable to refer the matter to the Department of Justice, which has taken appropriate action for the institution of legal proceedings upon complaints properly filed with the local United States attorney. It is understood that some convictions have been secured.

OYSTER INVESTIGATION IN THE YORK RIVER.

The investigation of the poor condition of oysters prevailing in a section of the York River, Va., since 1914, was brought to a conclusion during the year. The oysters have been consistently poor and watery and very generally affected with blue-green spots. Examination of the food content of the water revealed a condition of relative sterility. A special endeavor was made to determine the validity of the local belief that the trouble originated from toxic chemicals discharged from an industrial plant located on the banks of the river. With the cooperation of the Bureau of Chemistry, observations were made at intervals over a period of nearly a year, yet nothing was found in the effluents from the mill which could materially affect the oyster beds in any direct way. The trouble appears to rest upon the deficiency of food supply, but neither the biological nor the chemical studies served to fix a specific cause for the lack of food. The condition is presumed to result from natural causes which are at present obscure and therefore beyond control.

REPORT ON THE OYSTER INDUSTRY.

In the course of the year there was completed and sent to press a report comprising for public information a full account of the present condition and practices of the eastern oyster industry, both as it is based upon the exploitation of public oyster beds and as it manifests itself in the various phases of commercial oyster culture.[a] The report is published in response to the frequent demands upon the Bureau for information of the character furnished by it.

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[a] Churchill, E. P., jr.: The Oyster and the Oyster Industry of the Atlantic and Gulf Coasts. Appendix VIII, Report, U. S. Commissioner of Fisheries, 1919, 51 pp. Washington, 1920.

FRESH-WATER MUSSELS.

The Bureau continued the propagation of fresh-water mussels and investigation of problems affecting the mussel industries. The number of glochidia infected upon fish and liberated in the public waters was substantially greater than in the preceding year, and the unit cost per thousand correspondingly lower. The results of artificial propagation are detailed in another report.[a]

EXPERIMENTAL WORK.

Notable results were obtained in the experiments conducted at the Fairport station in rearing young mussels. The methods of artificial propagation, as regularly practiced, consist in liberating the fish immediately after infection, so that cultural operations are not involved. In the effort to improve upon the established practices, experiments have been conducted during several seasons in retaining infected fish during a period of two or three weeks, until the juvenile mussels are liberated, and then holding the young mussels, which at first are of microscopic dimensions, until they have attained a size (say one-half an inch in length) permitting of their being handled with convenience and planted deliberately upon bottoms which are known to be suitable. Simple as the task is in the stating, peculiar difficulties are encountered, and its accomplishment had baffled all previous attempts in this country and elsewhere. Before the past year a measurable degree of success had been attained at Fairport with one species of mussel (the Lake Pepin mucket). During the summer of 1919, the experiments conducted by Dr. F. H. Reuling led to the rearing of two additional species (yellow sand-shell and river mucket) in considerable quantities in small troughs supplied with naturally clarified river water.

Experiments having a somewhat similar object were conducted in Lake Pepin by Roy S. Corwin, scientific assistant. Here young mussels originating from artificial infections were reared in considerable quantities within inclosures on the bottom of the lake in relatively shallow water. Other experiments conducted at this place gave indication that glochidia carried over in the marsupia from the preceding year endured a shorter period of parasitism than those taken from the marsupia in the same season in which the eggs were deposited.

Dr. L. B. Arey, of Northwestern University Medical School, investigated the relations of glochidia to host as regards attachment and encystment, and the results of his investigations have been submitted for publication in another place.

PROTECTION OF MUSSELS.

In January, 1920, at La Crosse, Wis., the Bureau participated with officers of the Wisconsin Conservation Commission and the Minnesota Fish and Game Commission and other interested persons in a conference relative to the protection of fresh-water mussels. Acting upon the authority provided by recent concurrent legislation, it was determined to close against commercial shelling for a period of five years certain sections of the Mississippi River bordering the two States represented in the conference. The purpose is to allow opportunity for natural recuperation of the beds and to create favorable conditions for the artificial propagation of mussels.

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[a] Smith, Hugh M.: Report, U. S. Commissioner of Fisheries, 1920. Washington, 1920.

After several years of earnest effort by various persons and agencies, in which the Bureau of Fisheries has played a leading part, concurrent legislation for the protection of fresh-water mussels has been enacted in the four States which control the principal mussel-producing portions of the Mississippi River. It is hoped that the practical steps now being taken to give effect to that legislation will result in a marked recuperation of mussel beds which have been exhausted or seriously depleted.

PUBLICATION OF REPORTS.

In the course of the fiscal year there has appeared a document of the Bureau describing in detail the commercial fresh-water mussels, the implements and practices of the mussel fishery, and the machinery and methods of manufacture of buttons from the shells.[a] There has also been completed and submitted for publication a general account of the natural history and propagation of the mussels.[b] These papers are issued in response to a regular demand for the varied information contained in them, and with a view to disseminating such knowledge of the resources and industries and the conditions of their perpetuation as will stimulate the adoption of measures and practices whereby unnecessary waste may be avoided and the future, as well as the present, may be served.

OCEANOGRAPHIC AND LIMNOLOGICAL STUDIES.

WORK OF THE ALBATROSS.

The oceanographic and fishery work of the steamer *Albatross* had been entirely abandoned for the period of the war, and the vessel was engaged exclusively in the service of the Navy Department. Some changes in the vessel had naturally been made to adapt her to military service, but, before the return of the vessel, that department restored such features of plan and equipment as were desired by the Bureau. At the same time the Bureau, at its own expense, developed the fixed equipment of the vessel, so that she is now better fitted than ever before for fishing trials. The new equipment consists principally of a more powerful steam winch and other necessary fixtures for operating fishing trawls. There have also been purchased and placed upon the boat a series of otter trawls and other fishing gear.

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[a] Coker, R. E.: Fresh-Water Mussels and Mussel Industries of the United States. Bulletin, U. S. Bureau of Fisheries, Vol. XXXVI, 1917–18, pp. 11–89. Washington, 1919.

[b] Coker, R. E., Shira, A. F., Clark, H. Walton, and Howard, A. D.: Natural History and Propagation of Fresh-Water Mussels. Bulletin, U. S. Bureau of Fisheries, Vol. XXXVII, 1919–20. In press.

The greatest obstacle to the oceanographic work of the vessel has been the impossibility up to the present time of maintaining an adequate supply of dependable reversing thermometers for taking temperatures at varying depths. No American manufacturer is yet in position to furnish thermometers that meet the precise requirements for deep-sea work, and it is only after considerable delay that a limited number of satisfactory instruments have been obtained in London and Copenhagen.

The operations of the *Albatross* during the fiscal year covered two principal cruises. The first, beginning off Cape Henry at the close of October, 1919, extended as far as the Yucatan Channel in the south. The investigations aboard the vessel were directed by Mr. W. W. Welsh, scientific assistant. Biological and physical oceanographic stations were occupied on four sections across the Gulf Stream between Cape Henry and Key West; across Florida Strait, between Key West and Habana; from Habana to Cape San Antonio, at the western end of Cuba; across the Yucatan Channel to Cape Catoche; and from Cape Catoche to Dry Tortugas. Considering that the ship had been but recently placed in commission in the Fisheries Service, after having done duty in the Navy for two years, that much of her gear was new, and that practically her entire personnel was inexperienced in work of this character, her performance was regarded as satisfactory. The work is intended as a contribution to a scientific basis for fishery investigations by the ship during the next two years.

On February 18, after having undergone repairs at Baltimore, the *Albatross* sailed from Norfolk for Boston, to make headquarters for fishery and oceanographic investigations in the Gulf of Maine. On the trip to Boston she made three hauls with a 60-foot otter trawl in the vicinity of the 100-fathom curve, with the purpose of determining the occurrence of tilefish and other ground fish off the middle Atlantic coast. The results were negative. She also occupied a series of hydrographic stations on a line across Georges Bank. The vessel was engaged in the investigation of the Gulf of Maine until the latter part of April, after which she prosecuted a search for spawning haddock in Massachusetts Bay and returned to Baltimore to lay up for necessary repairs. This work was in continuation of investigations begun in the same waters by the *Grampus* in 1912, and is under the direction of Dr. H. B. Bigelow, of the Museum of Comparative Zoology, Cambridge.

The hydrographic and dredging records obtained on those cruises with all previous unpublished records of the vessel have been prepared for printing and will appear at an early time. The recent work of the *Albatross* in the Atlantic Ocean and Gulf of Mexico has been guided by the deputy commissioner, Dr. H. F. Moore, who will be able to coordinate many of the activities of this vessel with the observational work done under the International Ice Patrol Board, of which he is a member. Prior to the fall of 1919 the *Albatross* had not worked in the Atlantic since 1887.

SURVEY IN CHESAPEAKE BAY.

The biological and physical examination of the Chesapeake Bay, begun some years ago and interrupted by the conditions of war, has been resumed under the immediate supervision of Dr. R. P. Cowles as temporary investigator. The chief purpose is to determine the normal biological and physical conditions throughout the year. This done, there would then be normal data at hand from which to determine the abnormal conditions which bring about such serious mortalities of fish or oysters as have occurred in previous years. The survey should reveal all that is possible regarding the movements of layers of water of different densities, different temperatures, and different fish-food values, and should indirectly throw light upon the migrations of fish and crabs into or about the Bay. Special attention will be given to the "deep holes" and to the alleged barren bottoms at the mouths of rivers, and, through the collection of bottom deposits and the collaboration of the United States Geological Survey, information of value to geologists will be secured. In general the purpose is to gather as much as possible of the data which are essential for the conservation and development of the fisheries of this important body of water.

BIOLOGICAL AND PHYSICAL STUDIES OF INLAND LAKES.

The Bureau has continued to cooperate with the Wisconsin Biological and Natural History Survey in the studies of the fundamental conditions of inland lakes. The principal burden of these investigations is borne by the State, but it is not out of place to present here a brief statement of the status of the work, based upon a progress report submitted by President E. A. Birge and Mr. Chancey Juday. Bulletins on the plankton algæ, on gravimetric and chemical analyses of the plankton of the lakes in the vicinity of Madison, and on the bottom fauna in deeper water of Lake Mendota are now substantially or entirely completed. These reports comprise descriptions of many of the plankton elements and other units of fish-food supply, data regarding chemical composition (the basis of food value), and measures and computations of the quantities of the crops of organisms which maintain the productiveness of lakes in fish. Studies of the bacteria of Lake Mendota are in progress.

MISCELLANEOUS STUDIES.

REDDENING OF SALT FISH.

The salt-fish industry of the United States suffers a large annual loss as a result of the salt fish developing a red coloration when stored under moist conditions. Investigations conducted for the Bureau by Dr. W. W. Browne indicate that the development of the red coloration is due to the growth of two microorganisms, whose probable origin is the sea salt in which the fish are cured. This coloration may vary from a pale pink to a deep crimson. The pale pink coloration is produced as a result of the growth of a spirochete and the deep red by a bacillus form; these two organisms may, however, grow in such close harmony that the pigmentation may vary from a pale pink to red. It was formerly thought that the varied pigmentation was due to varied dilutions of the red pigment. The separation of the two organisms is very difficult owing to this close union.

The optimum concentration of salt for the growth of these microorganisms seems to be saturation. They grow well on heavily salted fish, brine, salt piles, and fish agar saturated with salt. No growth appears on media containing less than 15 per cent salt, by weight. Due to their sensitiveness to changes in density, staining of these bacteria for microscopical examination is very difficult. The morphology or shape of the organisms depends upon the concentration of salt in the medium, varying from the largest form (14–16 micra), found in heavily saturated media, to the spherical form (2 micra diameter) in media of 16 per cent concentration. Likewise all intermediate forms are present in the concentrations between 15 per cent and saturation. The amount, character, and pigmentation of the colonial does not seem to be affected by the varying changes in the concentration of salt.

The most favorable temperature for the growth of both the spirochete and the bacillus is between 50 and 60° C., indicating the salt lagoons of the Tropics as the probable source of the infection. Sunlight is not germicidal to these organisms, and this also points to their tropical origin, where the pigmentation is required as a protection against the bright sunlight; ordinary bacteria are killed by 10 minutes' exposure to bright sunlight. Influenced by age, by the accumulation of their own metabolic products, and particularly by low temperatures, both organisms suffer a temporary loss of pigmentation. During this loss the formation of the so-called "coccoid bodies" is noted in the pink spirochete. No change in the shape of the bacillus during the absence of pigment has been noted. After transplantation, both pigmentation and the regular vegetative form is resumed.

All results indicate that the causative agents of this troublesome and costly coloration have been discovered and that their original source is the solar evaporated sea salt in which the fish are cured. Both European and American sea salts are infected. Mined or domestic salt seems to be free of their presence. Any method devised for the elimination of this reddening of salted fish must be based upon either the proper disinfection of the sea salt before use or the substitution of mined or domestic salt which is free of infection. In either case a thorough disinfection of the salt fish plants and equipment is essential, since at the present time all are highly infected. It would be useless to dump sterilized salt or even mined salt into a highly infected plant or to bring unsterilized salt into a thoroughly disinfected plant.

With this knowledge of the life history of the organisms, the conditions essential for their growth, and the sources of infection, the Bureau already has under way experiments to determine the best and most practical means of eradicating a most troublesome factor from the salt-fish industry. During the entire series of experiments the Bureau has had the hearty cooperation of the salt-fish industries.

LOCATION OF FISH FROM AIRCRAFT.

In July, 1919, in cooperation with the Naval Aviation Service, W. W. Welsh, a scientific assistant in this Bureau with naval experience, made a flight at Cape May, N. J., to determine the possibilities of scouting for schooling fish with the aid of aircraft. The results of this trial were very favorable, but, since the development of the method and its application to the fisheries lies properly within the sphere of activity of another office of the Bureau, the further history of the matter does not pertain to this report.

JELLY FROM SEAWEEDS.

During last summer Prof. Irving A. Field conducted for the Bureau, in connection with the Woods Hole laboratory, investigations concerning the feasibility of deriving from marine algæ a gelatin suitable for use in the preservation of fish. The experiments of commercial packers have previously indicated that animal gelatins liquefied at such low temperatures that they could not be employed for this purpose. The jelly is not ordinarily used as a preservative in a strict sense, but as a medium in which the preserved fish are held and prevented from breaking to pieces in shipment.

Of all the algæ of the New England coast employed in the investigation only the Irish moss (*Chondrus crispus*) yielded gelatin—or, more correctly, gelose—in commercial quantities. It was found that Irish moss contained 79 per cent water and that the desiccated material was approximately 65 per cent gelose. The gelatinous extract from Irish moss is commonly known as "caragenin," but Dr. Field's experiments indicate that it is closely comparable to agar-agar. Agar-agar is made in Japan from another seaweed, *Gelidium corneum*, which is found to some extent on our Pacific coast and, in limited quantities, on the Atlantic coast.

The investigation developed provisional methods of preparation of caragenin, and a series of tests showed that 1¼ grams of the dried extract added to a 14-ounce can of fish was sufficient to form a firm jelly that prevented such soft fish as whiting and herring from breaking to pieces when subjected to the rough treatment of being transported 400 miles in the back of an automobile. The jelly in no way impaired the condition or the flavor of the fish. The preparation of the jelly in a form satisfactory for commercial uses remains to be investigated to a further stage. Other problems arising from the investigation relate to the decolorizing and purification of the jelly to adapt it for other possible uses. Experiments will also be made with other seaweeds from both coasts of the United States.

UTILIZATION OF FRESH-WATER TURTLES.

A relatively unutilized food resource is found in the several species of turtles of our fresh-water streams and lakes, notwithstanding that their near relative, the diamond-back terrapin of the sea coast (not to mention the highly prized green turtle of the ocean) is the greatest delicacy of the fish markets. In the endeavor to direct proper attention to this source of meat supply and to furnish the information requested by many correspondents, assistants were designated to investigate market and fishery conditions, particularly in the Mississippi Basin. The report by H. Walton Clark, scientific assistant. and J. B. Southall, shell expert, comprises information regarding the distribution and habits of the most useful species, an account of the seasons and methods of capture and marketing, and data concerning the preparation of the meats for use as food.[a] The report will undoubtedly serve a useful purpose in promoting the utilization of an available source of food and thereby will contribute to the prevention of waste of the Nation's food supply.

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[a] Clark, H. Walton, and John B. Southall. Fresh-Water Turtles: A Source of Meat Supply. Appendix VII, Report, U. S. Commissioner of Fisheries, 1919, 20 pp. Washington, 1920.

UTILIZATION OF FROGS.

The daily correspondence of the Bureau has indicated for a long time the widespread interest in frogs, their utilization and propagation, and their elimination from localities where they are not desired. Nevertheless the Bureau has not yet felt justified in diverting to experiments in frog culture facilities which are required for other useful purposes, especially in view of the extensive natural resources in frogs which are not now fully availed of. It has been deemed distinctly worth while, however, to acquire as full knowledge as possible of the useful species, their habits, conditions of life, breeding, life history, food, and enemies, as well as of the methods of capture employed. The report by Dr. A. H. Wright, temporary investigator, went to press during the year.[a] With this handbook the frog fisher or the prospective frog-culturist may readily identify the frogs in any stage—eggs, larvæ, tadpoles, or adults—and may be guided in the selection of environments for fishing or propagation.

THE BIOLOGICAL LABORATORIES.

The Navy Department having withdrawn from the Woods Hole (Mass.) station, the laboratory was reopened at the beginning of the fiscal year, with Dr. P. H. Mitchell as director. With a limited staff, investigations were pursued with reference to oysters (p. 21), gelatin from seaweeds (p. 29), the reddening of salt fish (p. 27), and the food and the parasites of fishes (pp. 19 and 18), the results of which have previously been indicated. Some experiments were also conducted by Dr. F. E. Chidester to determine some of the factors which influence the migrations of fishes and the behavior of fish in presence of certain chemicals. A miniature river system was employed, in which the fish were given a choice between two tributaries having water supply of different nature or current of different rates. It was found that the behavior of the fish varied according to season or condition of the animal, and particularly according to the rate of flow of the water; but—given a proper condition of stream flow, the first were repelled by some salts and attracted by others. The results will be published after further experiments are made.

The Beaufort (N. C.) laboratory, after occupancy by the Navy, since January, 1918, was turned over to the Bureau of Fisheries shortly after the beginning of the fiscal year. Since that time many necessary repairs and renewals have been made both by the Navy Department and by this Bureau. The date of the station's return prevented its opening on the usual scale for investigational work during the summer and fall. Small salaries have tended to making the personnel changeable and have prohibited the beginning of any broad investigational project. O. W. Hyman served as acting director during the summer and until the director, R. L. Barney, who was still absent on detail, could be returned to duty at the station. The director and three assistants, each of the latter for short periods, have devoted themselves to the preparation of a comprehensive report of the results of the experimental work on the propagation of the diamond-back terrapin. Attention has been given also to a study of a bacterial disease of the winter-fed yearling terrapin of the experimental broods. One temporary investigator has been engaged in the study of the life histories of crabs of the Beaufort region.

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[a] Wright, A. H. Frogs: Their Natural and Utilization. Appendix VI, Report, U. S. Commissioner of Fisheries, 1919, 44 pp. Washington, 1920.

At the Fairport (Iowa) biological station (A. F. Shira, director) a notable event of the year was the construction of the new laboratory authorized by the Congress to replace the former building destroyed by fire in December, 1917. The building which was nearly ready for occupancy at the close of the fiscal year is virtually fireproof, creditable in appearance, and admirably adapted for the purposes to be served. It contains laboratory space for all needs that are expected to develop in the near future. In all, $95,000 has been appropriated for construction and equipment, and, as the building cost about $83,000, there remained approximately $12,000 available for furniture and equipment, including the purchase of the necessary scientific apparatus and books. Before the close of the year sufficient equipment had been ordered to make it possible to occupy and use the building as soon as it could be accepted from the contractors.

The experimental work of the Fairport station in relation to fish culture (p. 13) and mussels (p. 24), the service in promoting the protection of mussels (p. 24), and the investigation of the utilization of turtles (p. 29) have been referred to. Field investigations were conducted in western Montana, where scattering mussels were found in the Musselshell River, though not in quantities permitting of commercial exploitation. Experiments were made in transplanting mussels to eastern waters. Progress was made in reporting upon the biological survey of Andalusia Chute, and an examination of portions of Lake Keokuk was undertaken. Studies, which were conducted at the station and not hitherto mentioned in this report, relate to the food of mussels (by H. W. Clark) and the acanthocephalid parasites of fishes (by Dr. H. J. Van Cleave).

At Key West, Fla. (S. F. Hildebrand, director), attention was devoted to construction and equipment of the biological station provided for that place. Owing to the lack of funds and the high cost and scarcity of material and labor only one permanent structure, a concrete water tower containing three tanks, was built. A small electric-light plant and two pumping units, one for salt and one for fresh water, were installed. Nets, glassware, and microscopes were added to the station's equipment for conducting investigations. The grounds were graded in part and improved by planting, and a metal flag staff was erected at a central and prominent point on the reservation.

The station was visited by a severe hurricane on September 9 and 10 which worked some damage to buildings and grounds and occasioned some expense in repairs to buildings and in regrading of grounds. It was not noticed that the storm had any effect upon the local fisheries, except that so many of the boats in the vicinity were wrecked that few fishermen were able to continue their occupation for some time; those that were able to go out obtained the usual catches.

Many collecting trips were made and observations gathered regarding the life histories and habits of fishes. An attempt was made to build up a representative series of the local fish fauna for future reference. Several species were obtained which had not hitherto been recorded from the vicinity of Key West. Observations of the markets were regularly made and reported, and it was found that, regardless of the handicap occasioned by the hurricane which destroyed or damaged many fishing boats, the catch of fish during the fiscal year 1920 was greater than during the preceding year, the increase applying particularly to kingfish and Spanish mackerel.

Investigation of the spawning of the mullet, *Mugil cephalus*, was made in the vicinity of the Ten Thousand Islands in December and January, but, although both nearly ripe and spent fish were found in course of the investigation, definite information of the time, place, and manner of spawning was not forthcoming. Observations upon the spiny lobster were continued as long as was practicable.

Examination was made of the quahaug or hard-clam beds in the vicinity of the Ten Thousand Islands and many data were obtained in regard to the abundance of clams, the manner and methods of catching them, and their commercial utilization. The investigation revealed the presence of such extensive resources in clams in this vicinity that an economic circular was prepared and issued by the Bureau to the trade.[a]

All positions connected with the Key West station, except that of engineer, became vacant in the course of the year, and the scientific work was therefore brought to a close in February. Since that time the station has remained inactive and in the charge of the engineer as caretaker. Regular incumbents for the positions at this station, including that of superintendent, have been unobtainable through the Civil Service Commission.

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[a] Clam Resources of the Ten Thousand Islands, Fla. Economic Circular 46, 5 pp. Washington, 1920.

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STEAMER "ALBATROSS"
1911-1920

Appendix III to the Report of the U. S. Commissioner of Fisheries for 1920

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STEAMER "ALBATROSS," 1911-1920.

INTRODUCTION.

On October 16, 1907, the U. S. Fisheries steamer *Albatross* left San Francisco, Calif., en route to the Philippine Islands on a cruise which covered a period of over two and one-half years of scientific investigation, during which stops were made at Midway, Guam, the Philippines, Borneo, Pratas Reef, China Sea, Dutch East Indies, and Formosa. The ship returned to San Francisco on May 4, 1910. The dredging and hydrographic records of this expedition have been published in the Bureau of Fisheries document No. 741, 1910.

On July 9, 1910, after two months' overhauling and preparation, the *Albatross*, under the command of Commander Guy H. Burrage, U. S. N., left San Francisco, Calif., for Alaska on a cruise of inspection, carrying on board the Secretary of Commerce and Labor and the Attorney General. The trip ended on September 20, 1910, when the ship reached San Francisco Bay.

No active work was engaged in until February 23, 1911, when a biological investigation was made along the coast of southern and Lower California, the Gulf of California, and the Guadaloupe Islands under the direction of Dr. C. H. Townsend, acting director of the American Museum of Natural History of New York City. An important result of this investigation was the rediscovery of the northern elephant seal, *Macrorhinus angustirostris* Gill, which was supposed to be extinct, and the capture alive of six yearlings, some of which lived for a considerable time at the New York Aquarium. The vessel returned to San Francisco on April 29, 1911, after making a series of dredge hauls along the California coast.

With but two weeks of preparation the *Albatross* was sent to Alaska to investigate the halibut and cod banks lying along the coast. A. B. Alexander, assistant in charge of the division of statistics and methods, directed the work, and Capt. J. B. Joyce had charge of the fishing operations. The cruise was completed about the middle of September, at which time the ship reached San Francisco.

Owing to the fact that the *Albatross* was found to be in an unseaworthy condition, no work was attempted outside of San Francisco Bay until April 12, 1914; but meanwhile, from January 30, 1912, to April 22, 1913, a biological survey of San Francisco Bay was carried out. A preliminary report on the physical conditions of the bay was published in 1914.[a] The direction of the work was vested in a board composed of three members—the commanding officer of the *Albatross*, the naturalist, and Dr. C. A. Kofoid, representing the University of California.

After being thoroughly repaired and overhauled under a special appropriation the *Albatross* left San Francisco on April 12, 1914, to investigate the waters off the coast of Washington and Oregon, with the object of determining their extent and value as fishing grounds. Edward Driscoll was in charge of the fishing operations, which were conducted by practical fishermen employed for the purpose. On June 12 the *Albatross* was sent to Alaska on a tour of inspection by Dr. E. Lester Jones, deputy commissioner, U. S. Bureau of Fisheries. The halibut investigation in the meantime was continued from the coast cities of Washington and Oregon by the naturalist, assistant, fishery expert, and the temporarily employed fishermen. The ship returned from Alaska on August 27, and from that time until the middle of September the investigations off the coast of Washington and Oregon were continued, after which the *Albatross* went to San Francisco.

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[a] A Report upon the Physical Conditions in San Francisco Bay, based upon the Operations of the U. S. Fisheries Steamer *Albatross* during the Years 1912 and 1913; by Francis B. Sumner, George D. Louderback, Waldo L. Schmitt, and Edward C. Johnston. University of California Publications in Zoology, vol. 14, No. 1, pp. 1-198, pls. 1-13, 20 text figs. Berkeley, 1914.

On July 1, 1915, the *Albatross* left San Francisco Bay for Seattle to continue the halibut investigations off the coast of Washington and Oregon started during the summer of 1914. This work was discontinued September 9 on account of adverse weather conditions, the ship returning to San Francisco Bay.

From October 11, 1915, to April 4, 1916, the vessel was laid up in San Francisco Bay for lack of funds for operation, being thoroughly overhauled and repainted by the crew during the enforced delay. From April 4 to November, 1916, she was engaged in an investigation of the tuna fisheries off the coasts of southern and Lower California. On May 2, 1917, she underwent repairs at Mare Island Navy Yard, and on their completion in November she was transferred to the Navy for the period of the war. She continued in naval service, principally in the Gulf of Mexico and the Caribbean Sea, until June 23, 1919, when she was returned to the Bureau.

After being refitted at Baltimore for fisheries investigations, including the installation of a new double winch, gallows, and other necessary appliances for using otter trawls, she proceeded from the capes of the Chesapeake on October 30, 1919, for oceanographic research under the direction of W. W. Welsh, on the South Atlantic coast and in the Gulf of Mexico, returning to Baltimore about the middle of December. On February 16, 1920, she sailed for Boston to take up investigations in the Gulf of Maine under the direction of Dr. H. B. Bigelow. In addition to the work in that region the vessel occupied several stations between Cape Henry and Cape Cod en route to Boston, and again on her return to Baltimore, where she arrived May 20, 1920.

F. M. Chamberlain, naturalist on the *Albatross*, was transferred and appointed agent, Alaska salmon fisheries, on August 23, 1911. L. M. Tongue, fishery expert, was transferred and appointed storekeeper, St. Paul Island, Alaska, in September. He was replaced by E. C. Johnston. Dr. F. B. Sumner was appointed naturalist on December 16, 1911, and R. A. Coleman, captain's clerk, in January, 1912.

Commander Guy H. Burrage, U. S. N., was detached from the *Albatross* on May 25, 1912, leaving Lieut. L. B. Porterfield senior officer on board. Lieut. Commander H. B. Soule, U. S. N., took command on June 10, 1912, and remained until April 4, 1914. Waldo L. Schmitt was appointed naturalist on December 13, 1913, Dr. F. B. Sumner having resigned on October 31, and E. P. Rankin was appointed assistant. On April 4, 1914, Lieut. L. B. Porterfield, U. S. N., relieved Lieut. Commander H. B. Soule, U. S. N., as commanding officer.

The position of naturalist was made vacant by the resignation of Waldo L. Schmitt on December 31, 1914. E. C. Johnston received the appointment as naturalist on April 1, 1915, leaving the position of fishery expert vacant. F. P. Shafer became fishery expert in October, 1915. Lieut. L. B. Porterfield, U. S. N., was detached and

Lieut. Commander J. J. Hannigan, U. S. N., made commanding officer on July 1, 1915. Mr. Johnston resigned from the position of naturalist October 18, 1917, to enter military service and was succeeded by E. P. Rankin December 1, 1917.

On the return of the vessel to the Bureau of Fisheries, June 23, 1919, Lieut. Commander C. D. Cochran, C. G. S., was in command, and he was succeeded on October 24, 1919, by Commander L. J. Wallace, U. S. N. Mr. Rankin resigned from the position of naturalist July 15, 1920.

EXPLANATION OF TABLES.

In Bureau of Fisheries document No. 741 the last *Albatross* dredging station was D. 5672 and the last hydrographic station H. 4937. The accompanying list gives the station numbers and the various investigations conducted by the *Albatross* from that point to the present time.

Lower California (Gulf of California) cruise	D. 5673–D. 5699 H. 4938–H. 4953
Alaska, 1911	H. 4954–H. 4955
Biological survey of San Francisco Bay [a] (1912–13)	D. 5700–D. 5849 H. 4956–H. 5350
Biological survey of San Francisco Bay (March, 1914)	H. 5351–H. 5365
Halibut investigation, 1914	H. 5366–H. 5774
Halibut investigation, 1915	H. 5775–H. 6408
Atlantic cruise south from Norfolk, 1919	C20001 to C20040
Atlantic cruise north from Norfolk, 1920	C20041 to C20130
Atlantic cruises surface temperatures while under way, 1919–20	

Prior to 1919 those stations at which the main object was the collection of specimens by dredging or trawling were designated as "D" stations and those where hydrographic and plankton collection was the object as "H" stations. Beginning in 1919 a single series of numbers is used and the stations at which collections are made are designated by the prefix letter "C," as "C20001."

The "Position" of a station is that point occupied by the vessel at the beginning of a haul or set of observations as determined by the navigator and plotted by him on the chart. On the halibut cruises of 1914 and 1915 the bearings and distances were worked out from the chart after the stations, indicated by small circles, had been plotted in by the navigator. In view of the fact that a large per cent of the stations on these two trips were within sight of land and that runs inshore were frequently made to check up the bearings, the percentage of error is very small. All bearings are "true" unless otherwise indicated. The charts used were either U. S. Hydrographic Office or U. S. Coast and Geodetic Survey, as indicated.

Where two figures are given under the heading "Time of day," "Depth," and "Temperature," the first represents the beginning and the second the end of the series of observations. Where one figure is given, it represents the beginning of the series of observations. In the case of the halibut fishing trials the time at which the dories left and returned to the ship is given in the "Remarks" column.

Temperatures are recorded in degrees Fahrenheit. The air and surface temperatures, except where indicated by an asterisk, have been taken from the ship's log. Their accuracy is not to be relied upon to any great extent owing to the unfortunate placing of the thermometer casing near the stack and the fact that the ship's thermometers have not been standardized. The bottom temperatures and those marked by an asterisk represent the corrected readings of tested Negretti-Zambra thermometers used in appropriate trip cases.

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[a] Loc. cit. in foot note on p. 3.

On the Lower California cruise, 1911, "Density" was determined by salinometer tests. "Salinity" determinations have all been made by titration with the standard outfit supplied by the International Council for the Exploration of the Sea.

The "Depth" of the "Trial" is that at which the gear was used, and under "Drift" are given the "Direction" and "Distance" through which the dredge was hauled. These are approximations. The "Duration" is the length of time consumed in towing the apparatus or the length of time allotted to a "set."

The current velocities given for stations H. 5351–H. 5365, inclusive, represent the readings of a Price current meter, which has been tested by the U. S. Bureau of Standards.

ABBREVIATIONS AND SYMBOLS.

The abbreviations and symbols used in the tables are listed below. For convenience the abbreviations used in describing the character of the bottom are listed separately.

9′ Ag	9-foot Agassiz beam trawl, including one tail weight and two wing weights; three glass floats; and a 150-pound sinker above the bridle, unless otherwise stated.
12′ Ag	12-foot Agassiz beam trawl, rigged as above.
Alb. smp	Albatross bottom-sampling apparatus. (Described on pp. 16–18, University of California Publications in Zoology, vol. 14, No. 1, pls. 12, 13. Berkeley, 1914.)
botm	bottom.
botm. net	frame, Welsh-Helgoland; net, strainer top, No. 10 silk bottom.
C	collecting station.
clsg. net	Bigelow frame, meter net, No. 000 top, No. 0 bottom.
80′ cod	80-foot cod trawl, otter rigged.
C. S	U. S. Coast and Geodetic Survey.
D	dredging or trawling station.
19″ dr	19-inch boat dredge. A fine-meshed net bag covered with a canvas bag, the mouth of which is held open by an iron frame 19 inches long by about 6 inches wide.
dyn	dynamite.
Ek. bot	Ekman reversing water bottle.
Ek. mtr	Ekman current meter.
Ek. smp	Ekman bottom-sampling apparatus.
El. sdr	electric (Weule) sounding machine.
30′ fldr	30-foot flounder trawl, otter rigged.
75′ fldr	75-foot flounder trawl, otter rigged.
GB bot	Greene-Bigelow water bottle.
H	hydrographic station.
Helgo. net	square frame of Helgoland; net, strainer top, No. 10 silk bottom; used as surface net.
H. O	U. S. Hydrographic Office.
Hvg. ln	heaving line and lead.
4′ inter	townet made of No. 000 silk, mounted on 48-inch metal ring.
Inter. sal	intermediate salinity.
Inter. temp	intermediate temperature.
L	left thermometer (looking toward the instrument).
25-lb. lead	cone-shaped sounding lead armed with soft soap.
28-lb. lead	
30-lb. lead	
32-lb. lead	
35-lb. lead	
Lt	light.
Luc. sdr	Lucas sounding machine, including a 35-pound detachable iron shot, unless otherwise stated.

m. b	mud bag ("boat dredge") usually fastened to tail of net or trawl.
mtr. net	1 meter diameter, 000-X top, 0-x bottom.
NZ	Negretti & Zambra reversing thermometer.
o. p. dr	regular commercial orange-peel bucket dredge.
oys. dr	oyster dredge.
P. N. bot	Pettersson-Nansen insulating water bottle.
Pr. m	Price current meter.
P. S. #9	Plotting sheet No. 9.
psc	per standard compass, magnetic variation not having been applied.
R	(in tables 1911–1915), right thermometer (looking toward instrument); (in tables 1919–20), Richter thermometer.
sdg	sounding.
35′ shr. trl	35-foot shrimp trawl, otter rigged.
Sigs. bot	Sigsbee water bottle.
Sigs. rod	Sigsbee sounding (bottom-sampling) rod.
5′ sldg	5-foot Tanner beam trawl improved by attaching a broad wooden "shoe" to each runner to prevent the frame from sinking in mud too far.
snap. ld	snapper-jawed sounding lead.
Sp. G	specific gravity.
subm. lt	submarine light.
surf	surface.
SV	Schmidt-Vossberg thermometer.
tang	tangent.
therm	thermometer.
3′ Tnr	3-foot Tanner beam trawl, including float, tail weight, and sinker above the bridle.
5′ Tnr	5-foot Tanner beam trawl, rigged as above.
9′ Tnr	9-foot Tanner trawl on Agassiz trawl frame.
Tnr.-Blish sdr	Tanner-Blish sounding machine.
Tnr. cse	Tanner reversing thermometer case.
Tycos	Tycos Instrument Co. Fahrenheit thermometer, used in surface work.
vert. net	½ meter diameter, No. 6 silk, used for vertical hauls except where otherwise stated.
wt	weight.
#6	½ meter diameter, No. 6 silk, surface tow net.
#10	½ meter diameter, No. 10 silk, surface net.
#12	plankton net, No. 12 bolting silk, mounted on 14-inch metal ring.
#20	(in tables 1911–1915), plankton net, No. 20 bolting silk, mounted on 14-inch metal ring. (Lohmann, 1911, states that this number was changed by the manufacturers in 1907 to "No. 25 bolting silk.") (In tables 1919–20), 12″ diameter, No. 20 silk, surface net.

"CHARACTER-OF-BOTTOM" ABBREVIATIONS.

Material:

C	Clay.
Co	Coral.
E. G	Eel grass.
For	Foraminifera.
G	Gravel.
Glob	Globigerina.
Lav	Lava.
M	Mud.
Mi	Mica.
Oz	Ooze.
P	Pebbles.
R	Rocks.
S	Sand.
Sh	Shells.
Shl	Shale.
Sp	Specks.
St	Stones.

Descriptive adjectives:

bk	black.
bl	blue.
bn	brown.

Descriptive adjectives—Continued.

brk	broken.
co	coral.
crs	coarse.
dk	dark.
fne	fine.
gn	green.
gran	granular.
gy	gray.
hrd	hard.
m	muddy.
med	medium.
pter	pteropod.
rd	red.
rky	rocky.
s	sandy.
sft	soft.
sh	shelly.
stk	sticky.
wh	white.
yl	yellow.

DREDGING AND HYDROGRAPHIC RECORDS SECURED

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Near boundary between Mexico and United States.					
D. 5673	3,782-ft. Cone (32° 18′ 30″ N., 116° 46′ W.), N. 42° E.; 4,900-ft. Cone (31° 36′ 30″ N., 116° 14′ 30″ W.), N. 82° E. (31° 26′ N., 117° 42′ W.).	*H. O.* 1006	1911. Mar. 1	6.11 a. m. to 10.30 a. m.	*Fms.* 1,090	bl. and gy. M., few Glob.
	Guadaloupe Id., east coast, northern end.					
H. 4938	Black Rk., near North Pt., N. 89° W., 1.5 miles (29° 10′ 20″ N., 118° 15′ 45″ W.).	1681	Mar. 2	6.55 a. m.	$\frac{0}{300}$	
H. 4939	Black Rk., near North Pt., N. 12° E.; Block House, S. 78° W. (29° 08′ 50″ N., 118° 17′ 50″ W.).	1681	...do.....	7.55 a. m.	290	hrd
H. 4940	Elephant Rk., S. 23° W.; Cone on N. side of Id., S. 71° E. (29° 09′ 30″ N., 118° 23′ W.).	1681	...do.....	9.10 a. m.	110	
H. 4941	Elephant Rk., S. 18° W.; Cone on N. side of Id., N. 75° E. (29° 09′ N., 118° 23′ 20″ W.).	1681	...do.....	9.25 a. m.	30	crs. bk. S
H. 4942	Elephant Rk., S. 1° W.; Cone on N. side of Id., N. 65° E. (29° 08′ 40″ N., 118° 24′ 10″ W.).	1681	...do.....	9.50 a. m.	27	.....do
H. 4943	Elephant Rk., S. 40° E.; Cone on N. side of Id., N. 60° E. (29° 08′ N., 118° 24′ 30″ W.).	1681	...do.....	10.05 a. m.	31	.....do
H. 4944	Elephant Rk., N. 46° E.; Steamer Pt. Rk., S. 11° E. (29° 06′ 50″ N., 118° 25′ W.).	1681	...do.....	10.25 a. m.	58	gy. S., Sh
H. 4945	Elephant Rk., N. 17° E.; Rk. at Steamer Pt., S. 7° E. (29° 06′ 20″ N., 118° 24′ 30″ W.).	1681	...do.....	11.00 a. m.	42	crs. bk. S
H. 4946	Midway between point at Elephant Rk. and Steamer Pt. Elephant Rk., N. 6° E.; Rk. at Steamer Pt., S. 21° E. (29° 04′ 50″ N., 118° 24′ W.).	1681	...do.....	11.30 a. m. 2.00 p. m.	25 12	.....do
	East side of Id.		...do.....	morning..		
	North of first party		...do.....	...do.....		
	Midway between point at Elephant Rk. and Steamer Pt.	1681	Mar. 3	night.....		

During the Lower California Cruise, 1911.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
° F. 56 58	° F. 56 58	° F.	....	....	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ.; Tnr. cse.; 12′ Ag.; m.b.	botm...	Min. 28	NE.......	Mi. 0.2	NZ #104914. Cable out 2,240 fms. Sp. G. (surf.) 24.2 at 15° C., (botm.) 25.0 at 13.8° C. Botm. therm. failed to trip. One bridle stop parted.
58	59	......	....	....	Tnr.-Blish sdr	300 fms.	....	....	.....	Guadaloupe Id. North Pt. appears to extend about 1 mile too far eastward from tangent bearing of east coast and patent log run on north side of Id. Reference made to position of North Pt. as given on chart 29° 10′ 50″ N., 118° 17′ 30″ W.
61	59	......	....	....	.....do........	botm...	....	....	.....	
63	59	......	....	....	.....do........	...do....	....	....	.....	
63	59	......	....	....	.....do........	...do....	....	....	.....	
64	59	......	....	....	.....do........	...do....	....	....	.....	
64	59	......	....	....	.....do........	...do....	....	....	.....	
64	59	......	....	....	.....do........	...do....	....	....	.....	
66	60	......	....	....	.....do........	...do....	....	....	.....	From this position groups of seals on the beach bore S. 75° E. and S. 48° E.
66 63	60 61	......	....	....	hand lead-line	...do....	....	....	.....	Rock at Steamer Pt. and Rt. Tang. Inner Id. in line.
....	.....	......	....	....	....	....	....	....	.....	Shore party collected various land and marine fauna and flora.
....	.....	......	....	....	....	....	....	....	.....	Shore party collected elephant seals.
....	.....	......	....	....	subm. lt.......	surf....	....	....	.....	Worms, eels, and fish were taken.

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Guadaloupe Id., east coast, northern end—Continued.					
		H.O	1911.		*Fms.*	
H. 4947	Rk. at Steamer Pt., S. 21° E.; Rt. Tang. Inner Id., S. 23° E. (29° 30″ N., 118° 24′ 30″ W.).	1681	Mar. 4	4.08 p. m.	89	hrd
H. 4948	Elephant Rk. and Rk. at Steamer Pt. in line, N. 2° W.; Rt. Tang. Inner Id., S. 22° E. (28° 59′ 30″ N., 118° 25′ 50″ W.).	1681	do.	4.12 p. m.	$\frac{0}{250}$	
H. 4949	Elephant Rk. and Steamer Pt. in line, N. 4° W.; Rt. Tang. Inner Id., S. 21° E. (29° 01′ 15″ N., 118° 23′ W.).	1681	do.	4.20 p. m.	226	fne. gy. S.
H. 4950	Steamer Pt., N. 26° W.; Rt. Tang. Inner Id., S. 21° E. (29° 01′ 15″ N., 118° 22′ 50″ W.).	1681	do.	4.43 p. m.	138	do.
	do.		do.	all day		
	Between San Diego, Calif., and San Benito Id., Mexico.					
H. 4951 D. 5674	3,782-ft. Cone, N. 22° E.; Bluff Peak (1,450 ft.), N. 78° E. (31° 28′ 45″ N., 117° 09′ 50″ W.).	1149	Mar. 8	6.04 a. m. to 8.37 a. m.	540	gn. M., fne. S., Glob.
	W. San Benito Id. S. side (anch.).		Mar. 9	a. m.	13	S., G., R.
	SE. Pt. W. San Benito Id., S. 62° W.; NE. Pt., N. 34° W.		do.	p. m.	13	
	Cerros Id.					
	South Bay (anch.); Prominent Black Rk., N. 58° W.; Rk. ½ mile E. of latter, N. 19° E.		Mar. 10	all day		
	S. part of E. side (anch.); E. Tang. Cerros Id., N. 26° E.; Morrow Redondo Pt., S. 5° W.		Mar. 11	do.		
	Middle of E. side (anch.); E. of 1,808-ft. Peak, Lat. 28° 13′ N.		Mar. 12	do.		S., R., G.
	Lower California.					
	Port San Bartolome (anch.); Coffin Rk. S. Tang., S. 65° W.; Entrance Rk., N. 68° W.		Mar. 13	all day		M., S., G.
	do.		Mar. 14	do.		do.
	San Cristobal Bay.					
	San Cristobal Bay (anch.); Morro Hermoso Pt., N. 59° W.; San Pablo Bluff, S. 10° E.		Mar. 15	a. m.	7	
D. 5675	San Pablo Pt., N. 33° E.; Asuncion Pt., N. 87° E. (27° 07′ 08″ N., 114° 33′ 10″ W.).	1310	do.	2.08 p. m. to 3.28 p. m.	284	gn. M., fne. S.
	Lower California.					
	San Roque Id. (anch.): NE. end of Id., S. 68° E.; W. end of Id., S. 10° W.		Mar. 15	all day		
	Abreojos (anch.): Abreojos Pt., S. 73° W.; 312-ft. Hill, N. 08′ W.		Mar. 16	do.	6	

DURING THE LOWER CALIFORNIA CRUISE, 1911—Continued.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
60	60	......	....	....	Tnr. Blish sdr.	botm...	......	....	....	
60	60	......	....	....	....do........	250 fms.	......	....	....	
60	60	......	....	....	....do........	botm...	......	....	....	
60	60	......	....	....	....do........	...do....	......	....	....	
....	....	......	....	....	....	....	......	....	....	Sealing party.
60 61	58 59	39.4	....	....	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ; Tnr. cse.; 12′ Ag.; m.b.	botm...	24½	N. 49° W..	2.4	Sdg. register read —50 at arrival of wt. at machine. Sigs. bot. failed to work. Cable out 1,300 fms. Sp. G. (surf.) 24.3 at 15.3° C.
....	....	......	....	....	seine........	....	......	....	....	Shore collecting. Seining party.
....	....	......	....	....	....	....	......	....	....	Shore collecting.
....	....	......	....	....	....	....	......	....	....	Shore collecting.
....	....	......	....	....	....	surf., 10 ft., 20 ft.	......	....	....	Do.
....	....	......	....	....	hand line; 19″ dr.; 3′ Tnr.; seine.	botm., 10 ft.	......	....	....	Shore collecting. Seining.
....	....	......	....	....	3′ Tnr.; seine.	botm., 5 ft.	......	....	....	Shore collecting. Seining.
....	....	......	....	....	3′ Tnr.; seine; sub. lt.	surf., 4 feet, botm.	......	....	....	Do.
....	....	......	....	....	....	....	......	....	....	Sealing party.
67	64 63	44.6	....	....	Luc. sdr.; Sigs. bot.; 12′ Ag.; m. b.	botm...	20	S. 50° W..	.7	Sigs. bot. used in sounding. Cable out 600 fms.
....	....	......	....	....	....	....	......	....	....	Shore collecting.
....	....	......	....	....	seine........	6 ft., 10 ft., botm.	......	....	....	Ballenas Bay. Shore collecting. Seining.

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Between Ballenas Bay and Santa Maria Bay.					
		H. O.	1911.		*Fms.*	
H. 4952 D. 5676	25° 31′ 15″ N., 113° 29′ 30″ W.	1493	Mar. 17	8.09 a. m. to 9.58 a. m.	645	gn. M., fne S., Glob.
H. 4953 D. 5677	25° 23′ 45″ N., 113° 16′ W.	1493	do	1.05 p. m. to 2.57 p. m.	735	do
	Santa Maria Bay (anch.): Hughes Pt., S. 10° W.; Mt. San Lazaro, N. 70° W.		Mar. 18	all day		S
	Magdalena Bay.					
	Off N. side of Santa Margarita Id. (anch.): Left Tang. Deering Bluff, N. 60° E.; NW. Tang. Id., N. 88° W.		Mar. 19	p. m.	8½	
	Mercy Channel (anch.): Cisne Pt., S. 70° W.; E. Tang. Santa Margarita Id., S. 46° E.		Mar. 20	all day		
D. 5678	Sail Rk. Entrada Pt., S. 53° W.; Redondo Pt., S. 15° W. (24° 35′ 20″ N., 111° 59′ 35″ W.).	1636	Mar. 21	9.58 a. m. to 10.25 a. m.	13½	S., brk. Sh.
	Off Magdalena (anch.): Magdalena Whf., S. 82° W.; Cove Pt., S. 57° E.		do	p. m.		M
	Between Magdalena Bay and San Lucas Bay.					
D. 5679	23° 47′ 45″ N., 111° 23′ W.	1664	Mar. 22	6.37 a. m. to 7.57 a. m.	325	dk. gn. M., For.
D. 5680	23° 40′ 30″ N., 111° 12′ 45″ W.	1664	do	10.05 a. m. to 11.52 a. m.	389	do
D. 5681	23° 33′ 15″ N., 111° 02′ 10″ W.	1664	do	2.05 p. m. to 3.26 p. m.	405	do
	San Lucas Bay.					
	San Lucas Bay (anch.): Cape San Lucas, S. 7° E.; Customhouse, N. 77° W.		Mar. 23	all day	13½	crs. S
D. 5682	Cabo Falso, N. 61° W.; Cape San Lucas, N. 11° W. (22° 48′ 20″ N., 109° 52′ 40″ W.).	1666	Mar. 24	7.27 a. m. to 9.05 a. m.	491	S
	San Lucas Bay (anch.): Cape San Lucas, S. 3° W.; Customhouse, S. 88° W.		do	all day		

DURING THE LOWER CALIFORNIA CRUISE, 1911—Continued.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
65 70	66 65	39.0	1.02449	1.02483	Luc. sdr.; Sigs. rod.; Sigs. bot.; NZ; Tnr.cse.; 12′ Ag.; m. b.	botm...	20	NW. by W.	0.2?	Cable out 1,000 fms. Sp. G. (surf.) 23.8 at 18.3°C., (botm.) 24.6 at 16°C.
70	66	38.6	1.02402	1.02885	Luc. sdr.; Sigs., rod.; Sigs. bot.; NZ; Tnr.cse.; 12′ Ag.; m. b.; #12, #20.	...do....	20	WNW....	.2	Cable out 950 fms. Townets towed astern for 50 min. during dredging. Sp. G. (surf.) 23.2 at 19.1°C., (botm.) 28.2 at 18°C.
....	.....	.....	....	....	19″ dr........	...do....	....	....	.....	Shore collecting. About 13 hauls with dr
....	.....	.....	....	....	....	....	....	....	.....	Shore collecting.
....	.....	.....	....	....	seine........	....	....	....	.....	Shore collecting. Mangrove and Santa Margarita Ids.
71	66	.....	....	....	12′ Ag.; m. b.; hand lead line; 14-lb. lead.	botm...	20	N. 81° W..	.6	Cable out 50 fms.
....	.....	.....	....	....	seine; 19″ dr...	...do....	....	....	.....	Shore collecting. Seining.
65	67	44.1	....	....	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ; Tnr.cse.; 12′ Ag.; 1 flat, 2 round m. b.	botm...	16	N. 68° W..	.2	Cable out 600 fms. Botm. water specimen lost in Lab. through oversight.
68 71	68	43.6	....	....	Luc. sdr.; Sigs. rod.; Sigs. bot.; NZ; Tnr.cse.; 12′ Ag.; 1 m. b.	...do....	21½	N. 68° W..	.2	Accumulator registered 3 or 4 tons on hauling in. Cable out 650 fms. Towed 16 min. at 600 fms. Sp. G. (surf.) 23.6 at 20°C., (botm.) 26.6 at 15°C.
70	68	43.3	....	....	.....do........	...do....	20	N. 68° W..	.2	Sigs. bot. failed to work. Cable out 650 fms.
....	.....	.....	....	....	seine; subm. lt.; 19″ dr.	surf., botm.	....	....	.....	Shore collecting. Seining.
69	69	40.8	....	....	Luc. sdr.; Sigs. rod.; Sigs. bot.; NZ; Tnr.cse.; 12′ Ag.; m. b.	botm...	20	S. 18° W..	.6	Sigs. bot. defective. Sp. G. (surf.) 24.2 at 25°C. Accumulator registered 3 tons in towing. Cable out 800 fms.
....	.....	.....	....	....	seine; subm; lt.	....	....	....	.....	Shore collecting. Seining. At night El. lt. used.

DREDGING AND HYDROGRAPHIC RECORDS SECURED

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	San Jose del Cabo Bay.	*H. O.*	1911.		*Fms.*	
	(anch.): Semaphore, S. 83° W.; Customhouse, N. 42° W.		Mar. 25 Mar. 26	all day		
	Gulf of California, Western Coast.					
	Pichilinque Harbor (anch.): SE. Tang. San Juan Id., S. 14° W.; SW. Tang. N. side of False Bay, S. 41° E.		Mar. 27 Mar. 28 Mar. 29	all day		
	Amortajada Bay, San Josef Id. (anch.): S. Tang. Cayo Id., S. 81° W.; Cayote Id., S. 12° E.		Mar. 30 Mar. 31	p. m		
	Agua Verde Bay (anch.): San Pasquel Pt., N. 10° W.; Opposite Pt., N. 83° E.		Apr. 1 Apr. 2	do a. m		
	Salenas Bay, Carmen Id. (anch.): Perico Pt., S. 63° E.; White Pt. S. 29° W.		do Apr. 3	p. m all day		
	Mulege, mouth of Concepcion Bay (anch): Sombrerito Pt., S. 44° W.; Gallito Pt., S. 54° E.		Apr. 4	do		
	S. part of Concepcion Bay (anch.): Concepcion Peak, S. 22° E.; 500′ Peak, S. 27° W.		Apr. 5 Apr. 6	p. m all day		
	S. part of Concepcion Bay (anch.): Ranada Pt., S. 83° W.; Rt. Tang. Ricason Id., S. 39° E.		Apr. 7 Apr. 8	do		
	San Francisquito Bay (anch.): NW. Tang., N. 11° E. E. Tang., N. 80° E.		Apr. 9	do		
	Angel de la Guardia Id., SE. side (anch.): E. Tang. Pond Id., N. 34° E.; E. Tang. Isla Partida, S. 28° E.		Apr. 10	p. m		
	Tiburon Id., S. side (anch.): Red Bluff Pt., S. 86° W.; S. Tang. Turners Id., S. 47° E.		Apr. 11 Apr. 12 Apr. 13	do all day a. m		
	Gulf of California.					
	San Estaban Id. (anch.); NE. Tang., N. 5° W.; 25′ Rk., S. 54° W.		Apr. 13 Apr. 14	p. m a. m		
	Santa Catalina Id. (anch.): Santa Cruz Id.		Apr. 16	do p. m		
	Pichilinque Harbor (anch.): Off Coaling Sta.		Apr. 17	all day		
	Espiritu Santo Id.: San Gabriel Bay (anch.).		do Apr. 18	do a. m		
	Ceralbo Id		Apr. 19	p. m		
	West coast, Lower California.					
D. 5683	Off Cape San Lucas: Cabo Falso, N. 53° W.; Cabeza Bellana N. (22° 46′ 45″ N., 109° 50′ 15″ W.).	1664	Apr. 20	12.41 p. m. to 2.49 p. m.	630	crs. S., gn. M., G.

During the Lower California Cruise, 1911—Continued.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
					seine					Shore collecting.
					subm. lt.; 19″ dr.					Shore collecting.
					subm. lt.; 19″ dr.; seine; dyn.	surf., botm.				Shore collecting. Four dredge hauls.
					seine; 19″ dr.	do				Shore collecting. Dredge hauls along the beach
					175′ seine; dyn.; 19″ dr.	do				Shore collecting.
					100′ seine; dyn.; 19″ dr.	do				Do.
					seine; 19″ dr.; dyn.; subm. lt.	surf., botm.				Do.
					175′ seine; dyn.; 19″ dr.	do				Do.
					dyn.; subm. lt.	surf				Shore collecting. El. lt. used at night.
					dyn.; 19″ dr.	botm				Shore collecting.
					subm. lt.; seine; dyn.	surf				Do.
										Shore collecting.
					dyn					Do.
					do					Do.
					dyn.; subm. lt.					Shore collecting. El. lt. used at night.
					dyn					Shore collecting.
70 69	73	39.1	1.02511	1.02329	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ Tnr. cse.; 12′ Ag.	botm	15	S. 26° W	1.5	One bridle stop carried away. Runners twisted. Sp. G. (surf.) 23.2 at 23.5°C., (botm.) 21 at 25°C. Cable out 1,200 fms.

Dredging and Hydrographic Records Secured

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	West coast, Lower California—Continued.					
		H. O.	1911.		*Fms.*	
D. 5684	S. of Magdalena Bay (23° 23′ 30″ N., 112° 30″ W.)	1664	Apr. 21	6.06 a. m. to 11.26 a. m.	1,760	....
D. 5685	S. of Abreojos Pt. (25° 42′ 45″ N., 113° 38′ 30″ W.)	1493	Apr. 22	8.08 a. m. to 10.26 a. m.	645	bk. S., Co.........
D. 5686	SW. of Abreojos Pt. (26° 14′ N., 114° W.)	1493	...do....	3.07 p. m. to 5.22 p. m.	930	gn. M., Glob......
....	Port San Bartolome (anch.): Entrance Rk., N. 79° W.; S. Tang. Coffin Id., S. 52° W.	....	Apr. 23	a. m......	....	....
	Coast of California.					
D. 5687	S. of Cerros Id.: W. Tang. Natividad Id., N. 10° E.; Breaker Pt., Lower Calif., N. 72° E. (27° 39′ 15″ N., 115° 16′ W.)	1310	Apr. 23	12.37 p. m. to 2.23 p. m.	480	gn. M., Glob......
D. 5688	W. Tang. Natividad Id., N. 15° E.; Breaker Pt. N. 72° E. (27° 38′ 45″ N., 115° 17′ 40″ W.)	1310	...do.....	2.30 p. m. to 4.23 p. m.	525	.....do............
D. 5689	E. of Guadaloupe Id.: Hat Mt., N. 59° E.; St. Vincent Peak, N. 47° E. (29° 23′ N., 116° 14′ W.)	1193	Apr. 24	6.11 a. m. to 8.49 a. m.	879	gy. M., fne. S., G., Glob.
D. 5690	East of Guadaloupe Id. (29° 29′ N., 116° 18′ W.)	1193	...do.....	10.07 a. m. to 12.57 p. m.	1,101	gn. M., Glob......
D. 5691	SW. of San Diego, Calif. (31° 08′ 20″ N., 118° 29′ 30″ W.).	1006	Apr. 25	6.06 a. m. to 8.45 a. m.	868	gy. M.............
D. 5692	SW. of San Diego, Calif. (31° 23′ 45″ N., 118° 31′ 30″ W.).	1006	...do.....	11.21 a. m. to 2.17 p. m.	1,076	.....do............
D. 5693	W. of San Nicolas Id. (33° 13′ 30″ N., 120° 04′ 30″ W.).	*C. S.* 5002	Apr. 26	6.06 a. m. to 7.52 a. m.	451	....

During the Lower California Cruise, 1911—Continued.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	F.	F.					Min.		Mi.	
64 66	67	.....	....	....	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ; Tnr. cse.; 12′ Ag.	botm...	30	NW. by W.	.....	250-lb. weight placed above bridle instead of 140-lb. Sounding wire carried away losing Sigs. bot., sounding cup and therm. Glass floats carried away. Accumulator registered over 5 tons. Cable out 3,015 fms.
60 61	61	.....	....	....	.....do........	..do....	30	W. by S..	.....	Sigs. bot. failed to work. NZ #108018, replacing #104914, did not register. Cable out 1,200 fms.
60 61	61	37.3	....	....	.....do........	...do....	20	...do.......	.....	Water specimen thrown out by mistake. Cable out 1,250 fms.
....	....	.....	....	....	250′ seine.....	....	....	....	.....	
61 62	60	41.1	1.02379	1.0248	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ Tnr. cse.; 12′ Ag.	botm...	30	S. 72° W..	1.5	Cable out 750 fms. Sp. G. (surf.) 24 at 15.7 °C., (botm.) 24.8 at 14.9°C.
62 61	60	39.9	1.02424	1.02482	.....do.......	...do....	30	S. 85° W..	2.0	Cable out 900 fms. Sp. G. (surf.) 24.1 at 15.5°C., (botm.) 25.3 at 12°C.
58	58	.....	1.02398	1.02564	.....do........	...do....	30	N. 87° W..	.....	Botm. therm. failed to register. Cable out 1,410 fms. Sp. G. (surf.) 24.1 at 14.2°C., (botm.) 26.2 at 11.5°C.
60	58	38.1	1.02385	1.02476	.....do........	...do....	18	S. 82° W..	.....	Cable out 1,600 fms. Sp. G. (surf.) 23.9 at 14.5°C., (botm.) 27.8 at 11.6°C. NZ #98244 replaced #108018.
57 58	59	37.2	1.02397	1.02563	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ; Tnr. cse.; 12′ Ag.	botm...	20	S. 82° W..	.....	Cable out 1,450 fms. Sp. G. (surf.) 24 at 14.6°C., (botm.) 26.27 at 11.8°C.
58 61	59 60	37.1	1.02362	1.02534	.....do........	...do....	20	...do.......	.....	Cable out 1,500 fms. Sp. G. (surf.) 23.6 at 15°C., (botm.) 25.8 at 12.2°C.
54 53	56 54	.....	....	....	.....do........	...do....	30	N. 86° W..	.....	Cable out 800 fms. Stray line carried away with all instruments.

DREDGING AND HYDROGRAPHIC RECORDS SECURED

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Coast of California—Contd.	*C. S.*	1911.		*Fms.*	
D. 5694	NW. of San Nicolas Id. (33° 24′ 36″ N., 120° 12′ 30″ W.).	5002	Apr. 26	9.09 a. m. to 11.28 a. m.	640	gn. M
D. 5695	(33° 33′ N., 120° 17′ 30″ W.).	5002	...do	1.08 p. m. to 3.22 p. m.	534	gn. S., Glob
D. 5696	W. of Pt. Buchon, Calif.: Pine Mt., N. 42° E. (35° 18′ 30″ N., 121° 28′ W.).	5002	Apr. 27	6.15 a. m. to 7.45 a. m.	440	
D. 5697	W. of Piedras Blanca, Calif.: Silver Peak, N. 40° E., Pine Mt., N. 75° E. (35° 35′ N., 121° 39′ W.).	5002	...do	10.02 a. m. to 11.42 a. m.	485	gn. M., bk. S
D. 5698	Off Pt. Sur, Calif.: Pt. Sur, N. 6° W.; Juniperro Mt., N. 47° E. (35° 50′ N., 121° 49′ 30″ W.).	5002	...do	2.02 p. m. to 3.48 p. m.	475	
D. 5699	Pt. Sur Lt., N. 12° E. (36° 30″ N., 122° W.).	5002	...do	6.07 p. m. to 8.11 p. m.	659	gn. M

DREDGING AND HYDROGRAPHIC RECORDS

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Off Coronation Id., Alaska.		1911.		*Fms.*	
H. 4954	5 miles ES., ¾ S. from the position (55° 57′ 30″ N., 135° 27′ W.).		Aug. 21	9.05 a. m.	134	C
H. 4955	38 miles SSW. ½ W. from Kerourat Id., Alaska (51° 29′ N., 131° 48′ W.).		Aug. 22	9.49 a. m.	1,368	bn. M

During the Lower California Cruise, 1911—Continued.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	*°F.*	*°F.*					*Min.*		*Mi.*	
60 56	57	......	1.02374	1.02483	Luc. sdr.; Sigs. rod; Sigs. bot.; NZ; Tnr. cse.; 12′ Ag.	botm...	30	S. 63° W..	.....	Cable out 1,200 fms. NZ #108154 replacing #98244 failed to trip. One bridle stop carried away. Sp. G. (surf.) 23.9 at 14°C., (botm.) 25 at 14°C.
58 57	57 56	38.9	1.02389	1.02466	.....do........	...do....	30	S. 85° W..	.....	Sounding register read —10 fms. when cup arrived at surf. Cable out 1,200 fms. Sp. G. (surf.) 24.2 at 13°C., (botm.) 25.3 at 11°C.
50 52	54	39.9	1.02346	1.02438	.....do........	...do....	13½	N. 63° W..	.....	Cable out 700 fms. Sp. G. (surf.) 23.9 at 12.2°C., (botm.) 25.1 at 10.5°C.
55 56	52 53	39.8	1.0236	1.02478	.....do........	...do....	31	N. 72° W..	.....	Cable out 750 fms. Sp. G. (surf.) 24 at 12.5°C., (botm.) 25.3 at 11.8°C.
53	53	39.9	1.02451	1.02450	.....do........	...do....	20	...do......	.....	Cable out 900 fms. Sp. G. (surf.) 24 at 12°C., (botm.) 25 at 11.9°C.
51 52	52	37.9	1.02373	1.02471	.....do........	...do....	30	S. 86°W...	.....	Cable out 1,000 fms. Sp. G. (surf.) 24.2 at 12°C., (botm.) 24.9 at 13.9°C.

Secured in Alaska, 1911.

Temperature.			Density.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surface.	Bottom.		Depth.	Duration.	Direction.	Distance.	
......	......	......	....	....	Luc. sdr.; Sigs. rod.	botm...	....	....	.....	
......	......	......	....	....	.....do........	...do....	....	....	.....	

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay.					
		C. S.	1912.		*Fms.*	
D. 5700 H. 4956	Angel Id. Lt., N. 24¾° E. Alcatraz Lt., S. 78¾° E. Tang. Lime Pt., S. 68¼° W.	5532	Jan. 30	10.00 a. m.	19 17	S., crs., fne. G., brk. Sh.
D. 5701 H. 4957	Alcatraz Lt., S. 87¾° E. Rt. Tang. Angel Id., N. 43½° E. Mile Rk. Lt., S. 52¾° W.	5532	...do...	1.20 p. m.	13 17	S., fne. G., brk. Sh.
D. 5702 H. 4958	Alcatraz Lt., S. 61¾° E. Lft. Tang. Angel Id., N. 20¼° E. Tang. Lime Pt., S. 53¼° W.	5532	...do...	2.54 p. m.	13 12¾	Sh., St.
D. 5703 H. 4959	Rt. Tang. Angel Id., S. 42° W. Southampton Lt., S. 83° E. Rt. Tang. Red Rk., N. 7° W.	5532	Feb. 1	10.10 a. m.	8½ 8¼	dk. gy. stk. M.
D. 5704 H. 4960	Center Red Rk., N. 13° W. Southampton Lt., S. 51° E. Rt. Tang. Angel Id., S. 32° W.	5532	...do...	2.09 p. m.	7¼ 7	...do...
D. 5705 H. 4961	Southampton Lt., N. 70° E. Quarry Pt., S. 1° E. Pt. Chauncey, N. 56° W.	5532	Feb. 6	9.50 a. m.	9 9	gy. M.
D. 5706 H. 4962	Lft. Tang. Goat Id., S. 31° E. Rt. Tang. Angel Id., S. 89° W. Southampton Lt., N. 1½° E.	5532	...do...	1.00 p. m.	9 7	...do...
D. 5707 H. 4963	Lft. Tang. San Quentin, N. 88⅔° W. Brothers Lt., N. 2° W. Bluff Pt., S. 4° W.	5532	...do...	2.15 p. m.	8 9¾	
D. 5708 H. 4964	Brothers Lt., N. 1⅔° E. Lft. Tang. San Quentin, S. 88° W. Bluff Pt., S. ⅔° W.	5532	...do...	2.37 p. m.	10½ 12¾	S. M.
D. 5709 H. 4965	Brothers Lt., N. 8⅓° E. Lft. Tang. San Quentin, S. 74⅓° W. Rt. Tang. Castro Pt., S. 55⅔° E.	5532	...do...	3.13 p. m.	12½ 10	M., S.
H. 4966	Alcatraz Lt., S. 62⅔° E. Angel Id. Lt., N. 73⅓° E. Yellow Bluff, Tang., S. 13⅔° E.	5532	Feb. 13	10.24 a. m.	7	bl. M.
H. 4967	Alcatraz Lt., S. 51° E. Angel Id. Lt., N. 14⅓° E. Lime Pt. Lt., S. 55⅓° W.	5532	...do...	11.06 a. m.	13	M.
H. 4968	Southampton Lt., N. 10° E. Alcatraz Lt., S. 27° W. Lft. Tang. Angel Id., N. 78° E.	5532	...do...	12.30 p. m.	20	gy. S.
H. 4969	Southampton Lt., N. 15° E. Alcatraz Lt., S. 18° W. Lft. Tang. Red Rk., N. 17¼° W.	5532	...do...	12.58 p. m.	17½	M.
H. 4970	Rt. Tang. Red Rk., N. 12° W. Southampton Lt., N. 60° E. Pt. Campbell, S. 72° W.	5532	...do...	2.15 p. m.	8	...do...
H. 4971	Southampton Lt., S. 69° E. Rt. Tang. Red Rk., N. 4° W. Pt. Stuart, S. 27° W.	5532	...do...	2.47 p. m.	12½	...do...
H. 4972	Rt. Tang. Red Rk., N. 13° E. Bluff Pt., S. 1½° W. Southampton Lt., S. 52° E.	5532	...do...	3.15 p. m.	7	hrd.
H. 4973	Southampton Lt., S. 48° E. Rt. Tang. Red Rk., N. 58° E. Bluff Pt., S. 17° E.	5532	...do...	3.47 p. m.	7	M.
H. 4974	Brothers Lt., N. 30° E. Lft. Tang. Red Rk., S. 62° E. Lft. Tang. San Quentin, S. 88° W.	5532	...do...	4.22 p. m.	9	...do...

Francisco Bay, Calif., 1912–13, and March, 1914.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.					Min.		Mi.	
56	51.83	53.13	....	....	9′ Ag.; 19″ dr.	botm...	18	327°.......	0.3	Bridle stops parted, frame tripped, and net torn.
57	50.83	......	....	....	.....do..........	...do....	17	358°.......	.4	Net carried away.
57	50.83	......	....	....	.....do..........	...do....	16½	61°........	.4	Trawl contained chiefly shells, few fair-sized stones in trawl; dr. did not drag properly.
57	49.83	52.93	....	....	9′ Tnr.; 19″ dr.	...do....	15½	353°.......	.8	One bridle stop had parted; on hoisting inboard net parted close to frame; frame was bent, boom likewise.
68	52.83	52.93	....	....	9′ Ag.; 19″ dr..	...do....	11	179°.......	.3	Accumulator registered nearly 7 tons; net gave way on haul in; was beyond redemption.
51	51.83	......	....	....	5′ Tnr.; 19″ dr. #12.	...do....	5	117°.......	.4	Mud filled with worm tubes and ophiurians.
55	51.83	......	....	....	.....do..........	...do....	6	2°.........	.4	Fewer worm tubes than preceding; few, if any, ophiurians. No complete examination or inventory was made of contents of haul.
54.5	51.83	......	....	....	.....do..........	...do....	8	331°.......	.4	Boat dr. was not tied, hence botm. not accurately determined.
55	51.83	......	....	....	9′ Ag.; 19″ dr.; #12.	...do....	14½	338°.......	.6	
56	51.83	......	....	....	5′ Tnr.; 19″ dr. #12.	...do....	13½	212°.......	.5	
55	54.23	53.93	29.10	30.48	Sigs. bot.; #12; #20; Tnr. cse.	surf. and botm.	10	Against tide.	.....	Strong ebb.
55	53.83	53.93	29.53	31.01	.....do..........	...do....	10	...do.......	.....	Do.
56	53.83	53.93	27.59	26.10	.....do..........	...do....	10	...do.......	.....	Strong ebb; lost #20 townet; was fouled in propeller strut.
56	54.03	55.73	26.49	28.40	Sigs. bot.; Tnr. cse.; #12.	...do....	10	...do.......	.....	Strong ebb.
57	53.83	53.83	26.96	28.46	.....do..........	...do....	10	...do.......	.....	Do.
56	53.83	53.73	26.16	26.32	.....do..........	...do....	10	...do.......	.....	Do.
56	53.73	53.83	23.91	25.39	.....do..........	...do....	10	...do.......	.....	Ebb.
57.5	53.73	53.73	18.23	22.76	.....do..........	...do....	10	...do.......	.....	Do.
58	53.73	53.53	17.47	21.74	.....do..........	...do....	10	...do.......	.....	Do.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Upper section of bay.	*C. S.*	1912.		*Fms.*	
H. 4975	Tang. Crockett Whf., S. 74° E. Carquinez Lt., N. 50° W. Tang. Selby Whf., S. 69° W.	5533	Feb. 15	1.10 p. m.	14½	hrd
H. 4976	Tang. Crockett Whf., S. 76° E. Carquinez Lt., S. 48° E. Mare Id. Lt., N. 27° W.	5533	...do.....	1.43 p. m.	10½	bl. M
H. 4977	Carquinez Lt., N. 71° E Lone Tree Pt. Whf., S. 36° E. Pinole Pt. Tang., S. 53½° E.	5533	...do.....	2.20 p. m.	5¾	.....do
H. 4978	Mare Id. Lt., N. 66° E Lone Tree Pt. Whf., S. 82° E. Pinole Pt., S. 41° W.	5533	...do.....	2.48 p. m.	5	.....do
H. 4979	Mare Id. Lt., N. 63° E Brothers Lt., S. 32° W. Lft. Tang. Pinole Pt., S. 54° E.	5533	...do.....	3.20 p. m.	7	M
H. 4980	Pinole Pt. Lft. Tang., N. 76° E. Lft. Tang. Sisters, S. 58° W. Brothers Lt., S. 23° W.	5533	...do.....	3.48 p. m.	6¼	.....do
H. 4981	Brothers Lt., S. 7° E Lft. Tang. Sisters, N. 22° W. Lft. Tang. Pinole Pt., N. 59° E.	5533	...do.....	4.17 p. m.	13	.....do
	Middle section of bay.					
D. 5710 H. 4982	Lime Pt., N. 77° E Alcatraz, Lft. Tang., N. 70° E. Angel Id. Lt., N. 9° E.	5532	Feb. 16	9.38 a. m.	16 9	Sh., hrd. M
D. 5711 H. 4983	Lime Pt., N. 68° W Angel Id. Lt., N. 6° E. Alcatraz Lt., N. 63° E.	5532	...do.....	10.00 a. m.	8½ 9¾	M., S., Sh
D. 5712 H. 4984	Lime Pt., N. 87° W Angel Id. Lt., N. 6° W. Alcatraz Lt., N. 79° E.	5532	...do.....	11.04 a. m.	10½ 14¾	gy. S., Sh
D. 5713 H. 4985	Alcatraz Lt., N. 10° E Angel Id. Lt., N. 19° W. Lime Pt., N. 78½° W.	5532	...do.....	1.47 p. m.	17 10	gy. S., P
	Upper section of bay.					
H. 4986	Tang. Crockett Whf., S. 74° E. Carquinez Lt., N. 53° W. Tang. Selby Whf., S. 80° W.	5533	Feb. 20	11.39 a. m.	12¼	sft. M
H. 4987	Tang. Crockett Whf., S. 70½° E. Carquinez Lt., N. 28° E. Mare Id. Lt., N. 50° W.	5533	...do.....	12.45 p. m.	8	stk. M
H. 4988	Carquinez Lt., N. 69° E Lone Tree Pt. Whf., S. 38° E. Pinole Pt., S. 55° W.	5533	...do.....	1.35 p. m.	7	br. M
H. 4989	Mare Id. Lt., N. 65° E Lone Tree Pt. Whf., S. 82° E. Pinole Pt., S. 42° W.	5533	...do.....	2.13 p. m.	6¾	M
H. 4990	Lft. Tang. Sisters, S. 53° W Brothers Lt., S. 31° W. Lft. Tang. Pinole Pt., S. 73° E.	5533	...do.....	2.59 p. m.	7	.....do
H. 4991	Rt. Tang. Sisters, S. 63° W Pinole Pt., N. 74° E. Brothers Lt., S. 25° W.	5533	...do.....	3.24 p. m.	7	.....do
H. 4992	Brothers Lt., S. 4° E Lft. Tang. Sisters, N. 36° W. Lft. Tang. Pinole Pt., N. 60° E.	5533	Feb. 21	10.25 a. m.	12¾	gy. S
	Middle section of bay.					
H. 4993	Lft. Tang. Red Rk., S. 87° E. Brothers Lt., N. 26° E. Lft. Tang. San Quentin, N. 89° W.	5532	Feb. 21	11.00 a. m.	8	hrd. M., S
H. 4994	Brothers Lt., N. 14° E Bluff Pt., S. 16° E. Rt. Tang. Red Rk., N. 44° E.	5532	...do.....	11.35 a. m.	7	bk. S., hrd. M

FRANCISCO BAY, CALIF., 1912-13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
55	53.83	53.63	13.91	18.56	Sigs. bot.; Tnr. cse.; #12, #20.	surf. and botm.	10	Against tide.	.....	Strong ebb.
57	53.83	53.63	13.94	17.68	.....do..........	...do....	10	...do.......	.....	Strong ebb; as botm. therm. was tripped before 10-min. period had elapsed, botm. temp. was taken again.
58	53.73	53.83	15.10	19.85	.....do..........	...do....	10	...do.......	.....	Strong ebb.
54.5	53.63	53.93	14.19	21.47	.....do..........	...do....	10	...do.......	.....	Do.
58	54.03	53.93	21.54	22.11	.....do..........	...do....	10	...do.......	.....	Do.
58.5	53.83	53.93	19.02	21.28	.....do..........	...do....	10	...do.......	.....	Do.
59	53.33	54.03	21.41	22.51	.....do..........	...do....	10	...do.......	.....	Do.
56.5	51.83	......	......	......	5′ Tnr.; 19″ dr.; #12, #20.	botm...	4	90°........	0.4	Flood.
59	51.83	......	......	......	.....do..........	...do....	4	101°.......	.25	Do.
58	51.83	......	......	......	5′ Tnr.; 19″ dr.; m. b.; #12, #20.	...do....	5	107°.......	.3	Do.
55	51.83	......	......	......	.....do..........	...do....	28⅓	270°.......	1.2	Ebb.
56	54.03	54.13	7.01	12.67	Tnr. cse.; Sigs. bot.; 4′ inter.; #12, #20.	surf. and botm.	10	Against tide.	.....	Flood.
63	54.23	54.53	13.33	17.40	.....do..........	...do....	10	...do.......	.....	Flood; net touched bottom.
62.5	55.33	54.73	11.35	19.57	.....do..........	...do....	8	...do.......	.....	Flood; full of mud; most of catch of #20 townet let go because of mud.
62	55.23	54.83	21.42	21.12	.....do..........	...do....	7	...do.......	.....	Slight flood.
62	55.13	54.73	24.22	24.19	.....do..........	...do....	12	...do.......	.....	Do.
62	54.83	54.83	24.03	24.77	.....do..........	...do....	12	...do.......	.....	Slack water changing to fairly strong ebb.
58	54.13	54.63	18.95	23.95	.....do..........	...do....	....	...do.......	.....	Flood; slow stream.
58	54.33	54.63	22.35	24.49	Tnr. cse.; Sigs. bot.; 4′ inter.; #12, #20.	surf. and botm.	10	Against tide.	.....	Flood.
56.5	54.63	54.43	23.77	25.35	.....do..........	...do....	7	...do.......	.....	Do.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1912.		*Fms.*	
H. 4995	Southampton Lt., S. 47° E.. Bluff Pt., S. 9° W. Rt. Tang. Red Rk., N. 7° E.	5532	Feb. 21	11.55 a. m.	7	....
H. 4996	Bluff Pt., S. 42° W.......... Southampton Lt., S. 66° E. Rt. Tang. Red Rk., N. 5° W.	5532	...do.....	1.25 p. m.	12¼	stk. M...........
H. 4997	Southampton Lt., N. 66° E.. Pt. Campbell, S. 69° W. Lft. Tang. Red Rk., N. 14° W.	5532	...do.....	1.50 p. m.	9½	M...............
H. 4998	Southampton Lt., N. 23° E.. Pt. Blunt, S. 32° W. Pt. Simpton, N. 56° W.	5532	...do.....	2.10 p. m.	14½	.....do............
H. 4999	Pt. Blunt, N. 80° W......... Southampton Lt., N. 14° E. Alcatraz Lt., S. 21° W.	5532	...do.....	2.35 p. m.	18½	S., M.............
H. 5000	Alcatraz Lt., S. 56° E........ Fort Pt., S. 40° W. Angel Id. Lt., N. 10° E.	5532	...do.....	3.10 p. m.	14	hrd...............
	Lower section of bay.					
H. 5001	No. 2 Beacon, S. 36° E....... San Bruno Lt., N. 60° W. Pt. San Mateo, S. 23° W.	5531	Feb. 23	11.30 a. m.	6	M...............
H. 5002	Candlestick Pt., N. 43° W... San Bruno Lt., S. 88° W. Pt. Avisadero, N. 23° W.	5531	...do.....	12.50 p. m.	5	.....do............
H. 5003	Candlestick Pt., N. 47° W... San Bruno Lt., S. 65° W. Pt. Avisadero, N. 24° W.	5531	...do.....	1.20 p. m.	4	.....do............
H. 5004	Candlestick Pt., N. 54° W... San Bruno Lt., N. 42° W. Pt. Avisadero, N. 23° W.	5531	...do.....	1.50 p. m.	5	.....do............
H. 5005	Shag Rk., N. 48° W.......... San Bruno Lt., S. 21° W. Candlestick Pt., N. 71° W.	5531	...do.....	2.15 p. m.	6¾	.....do............
H. 5006	Shag Rk., S. 58° W.......... Rt. Tang. Pt. Avisadero, S. 74° W. Goat Id. Lt., N. 21° W.	5531	...do.....	2.50 p. m.	7	.....do............
H. 5007	Goat Id. Lt., N. 23° W....... Ferry Bldg., N. 54° W. Pt. Avisadero, S. 19° W.	5531	...do.....	3.20 p. m.	7	.....do............
H. 5008	Rt. Tang. Goat Id., N. 15° E. Lft. Tang. Goat Id., N. 5° W. Ferry Bldg., N. 72° W.	5531	...do.....	4.00 p. m.	12¾	.....do............
H. 5009	Rt. Tang. Goat Id., N. 19° E. Lft. Tang. Goat Id., N. 7° W. Ferry Bldg., N. 8° W.	5531	Feb. 27	10.30 a. m.	11	S., M.............
H. 5010	Pt. Avisadero, S. 22° W..... Goat Id. Lt., N. 26° W. Ferry Bldg., N. 57° W.	5531	...do.....	11.15 a. m.	7½	.....do............
H. 5011	Pt. Avisadero, S. 12° W..... Goat Id. Lt., N. 16° W. Ferry Bldg., N. 54° W.	5531	...do.....	11.35 a. m.	10	.....do............
H. 5012	Rt. Tang. Pt. Avisadero, S. 71° W. Goat Id. Lt., S. 55° W. Shag Rk., N. 22° W.	5531	...do.....	12.50 p. m.	7½	M...............
H. 5013	Candlestick Pt., N. 73° W... Shag Rk., N. 49° W. San Bruno Lt., S. 18° W.	5531	...do.....	1.25 p. m.	6¼	bk. M...........
H. 5014	Candlestick Pt., N. 55° W... San Bruno Lt., S. 43° W. Pt. Avisadero, N. 26° W.	5531	...do.....	1.55 p. m.	4¾	M...............
H. 5015	Candlestick Pt., N. 40° W... San Bruno Lt., S. 66° W. Pt. Avisadero, N. 22° W.	5531	...do.....	2.15 p. m.	4¾	.....do............

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
55	54.63	54.23	25.20	27.59	Tnr. csc.; Sigs. bot.; 4′ inter.; #12, #20.	surf. and botm.	3	Against tide.	.....	Flood.
54	.....	54.93	26.78	29.14	.....do.........	...do....	13	...do......	.....	Flood; slow stream.
55	55.23	54.23	....	28.74	.....do.........	...do....	6	...do......	.....	Do.
55	54.63	54.03	28.40	28.92	.....do.........	...do....	10?	...do......	.....	Do.
56	54.53	54.03	28.23	28.14	.....do.........	...do....	8	...do......	.....	Do.
57	53.93	53.93	31.00	31.18	.....do.........	...do....	......	...do......	.....	Slack.
53	54,23	54.33	28.53	27.30	Tnr. csc.; Sigs. bot.; 4′ inter.; #12, #20.	surf. and botm.	9	Against tide.	.....	Flood; moderate current, nearly slack at end.
55	54.73	54.63	28.56	28.40	.....do.........	...do....	7	...do......	.....	Do.
57	54.83	54.63	28.29	28.33	.....do.........	...do....	9	...do......	.....	Do.
57	54.83	54.63	28.14	28.02	.....do.........	...do....	7	...do......	.....	Do.
57	54.83	54.63	27.87	27.83	.....do.........	...do....	6	...do......	.....	Do.
57	54.53	55.13	27.48	27.52	.....do.........	...do....	6	...do......	.....	Flood; moderate current, nearly slack at end. Mud haul, townets emptied, mud in bag of one saved.
56	54.43	53.93	26.94	27.17	.....do.........	...do....	8	...do......	.....	Flood; moderate current, nearly slack at end.
56	54.73	53.73	27.68	27.85	.....do.........	...do....	7	...do......	.....	Do.
49	52.63	51.53	27.37	28.84	.....do.........	...do....	7	...do......	.....	Swift ebb at outset. Water very much clearer than on last few working days.
50	52.83	52.53	27.01	27.72	.....do.........	...do....	10	...do......	.....	Ebb. Passed abruptly into muddy water.
51	50.33	52.43	27.40	27.11	.....do.........	...do....	4	...do......	.....	Ebb. Return was made to blue water a few hundred yds. from line of division. After churning with propeller the Surf. Sal. was 27.52.
51	53.33	52.93	27.81	27.65	.....do.........	...do....	7	...do......	.....	Ebb.
51.5	53.13	53.13	27.79	27.75	.....do.........	...do....	10	...do......	.....	Do.
53	52.83	52.83	28.11	28.12	.....do.........	...do....	9	...do......	.....	Do.
53	53.03	52.93	28.23	28.28	.....do.........	...do....	6	...do......	.....	Do.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.	*C. S.*	1912.		*Fms.*	
H. 5016	Candlestick Pt., N. 41° W... San Bruno Lt., S. 89° W. Pt. Avisadero, N. 21° W.	5531	Feb. 27	2.30 p. m.	4¾	M................
H. 5017	San Bruno Lt., N. 57° W.... San Mateo Pt., S. 13° W. No. 2 Beacon, S. 41° E.	5531	...do.....	3.00 p. m.	5¼	.....do.............
	Middle section of bay.					
D. 5714 H. 5018	Brothers Lt., N. 40° E....... Rt. Tang. Red Rk., S. 27° E. San Pedro Pt., N. 2° E.	5532	Feb. 28	10.15 a. m.	15 9	bk. S., M., Sh.....
	Upper section of bay.					
D. 5715 H. 5019	Brothers Lt., S. 11° W....... Rt. Tang. Sisters, N. 86° W. Pt. Pinole, N. 64° E.	5533	...do.....	11.07 a. m.	9½ 13½	gy. S., gy. M......
D. 5716 H. 5020	Pt. Pinole, N. 80° E......... Brothers Lt., S. 23° W. Rt. Tang. Sisters, S. 55° W.	5533	...do.....	1.10 p. m.	6 9	sft. M.............
D. 5717 H. 5021	Mare Id. Lt., N. 64° E....... Pt. Pinole, S. 77° E. Brothers Lt., S. 29° W.	5533	...do.....	2.05 p. m.	7 6¾	.....do.............
	Middle section of bay.					
D. 5718 H. 5022	Quarry Pt., S................ Chauncey Pt., N. 57½° W.... Southampton Lt., N. 76° E.	5532	Feb. 28	3.19 p. m.	7½ 9	gy. M.............
	Upper section of bay.					
D. 5719 H. 5023	Pinole Pt., S. 52° E.......... Mare Id. Lt., N. 66° E. Brothers Lt., S. 30° W.	5533	Mar. 1	10.45 a. m.	6¼ 6	M................
D. 5720 H. 5024	Lft. Tang. Crockett Whf., S. 68° E. Rt. Tang. Selby Whf., S. 74° W. Carquinez Lt., N. 57° W.	5533	...do.....	1.13 p. m.	14¾ 11	sft. M., m. S.......
D. 5721 H. 5025	Carquinez Lt., N. 41° E..... Mare Id. Lt., N. 32° W. Lft. Tang. Crockett Whf., S. 76° E.	5533	...do.....	1.49 p. m.	8½ 8	M., S., St.........
D. 5722 H. 5026	Carquinez Lt., N. 74° E..... Lft. Tang. Selby Whf., E. Lone Tree Pt., S. 42° E.	5533	...do.....	2.44 p. m.	5¼ 4¾	M., Sh............
	Lower section of bay.					
D. 5723 H. 5027	Rt. Tang. Mission Rk., N. 81° W. Goat Id. Lt., N. 1° E. Ferry Bldg., N. 46° W.	5531	Mar. 6	10.09 a. m.	9½ 11	bk. M., Sh........
D. 5724 H. 5028	Goat Id. Lt., N. 20½° W..... Rt. Tang. Mission Rk., N. 53° W. Shag Rk., S. 45° W.	5531	...do.....	1.21 p. m.	8¾ 9½	sft. M., Sh.........
D. 5725 H. 5029	Goat Id. Lt., N. 21½° W..... Shag Rk., S. 61° W. San Bruno Lt., S. 20° W.	5531	...do.....	1.50 p. m.	7½ 7	sft. M..............
D. 5726 H. 5030	Shag Rk., W.................. Goat Id. Lt., N. 17° W. San Bruno Lt., S. 23½° W.	5531	Mar. 8	10.38 a. m.	6¾ 7¼	bk. S., M..........
D. 5727 H. 5031	Shag Rk., N. 63° W.......... Goat Id. Lt., N. 13° W. San Bruno Lt., S. 27° W.	5531	...do.....	12.40 p. m.	6¼ 5¼	stk. bk. M........
D. 5728 H. 5032	Shag Rk., N. 36° W.......... Candlestick Pt., N. 57° W. San Bruno Lt., S. 27½° W.	5531	...do.....	1.19 p. m.	5 5	S., bk. M., Sh......
D. 5729 H. 5033	Shag Rk., N. 28½° W......... Candlestick Pt., N. 43° W. San Bruno Lt., S. 59° W.	5531	...do.....	2.37 p. m.	4¾ 4¾	bk. M., Sh........
D. 5730 H. 5034	Shag Rk., N. 26½° W......... San Bruno Lt., S. 77° W. Candlestick Pt., N. 39½° W.	5531	...do.....	3.11 p. m.	5 5½	bk. M.............

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
53.5	52.83	52.93	28.28	28.25	Tnr. cse.; Sigs. bot.; 4′ inter.; #12, #20.	Surf and botm.	7	Against tide.		Ebb.
54.5	52.33	52.73	28.38	28.33	do	do	8	do		Do.
60	50.00				5′ Tnr.; 19″ dr.	botm	18	172°	0.8	Ebb.
64	50.00				5′ Tnr.; 19″ dr.	botm	15½	199°	1.0	Ebb.
78	51.00				5′ Tnr	do	15	221°	1.0	Do.
78	51.00				do	do	13	224°	1.0	Do.
63	51.00				5′ Tnr.; 19″ dr.	botm	22	124°	.9	Ebb. Quantities of worm tubes and ophiurians.
55	51.00				5′ Tnr.; 19″ dr.	botm	20	44°	.7	Flood. Boat dr. net lost.
54	52.00				5′ Tnr.; m. b	do	11	258°	.4	Ebb.
54	52.00				9′ Ag.; m. b	do	28½	265°	1.0	Do.
53	52.00				do	do	25¾	245°	1.0	Do.
54	50.00				5′ Tnr.; m. b	botm	3	121°	.3	Flood. Abundant ophiurians.
50	50.00				9′ Ag.; m. b	do	10	172°	.4	Flood.
52	50.00				5′ Tnr.; m. b	do	14	82°	.4	Do.
51.5	51.50				9′ Ag.; m. b	do	17	340°	.3	Ebb.
62.5	52.00				do	do	15	154°	.7	Flood.
62.5	52.00				5′ Tnr.; m. b	do	35	162°	.7	Do.
62	52.00				9′ Ag.; m. b	do	13	159°	.6	Do.
64.5	52.00				do	do	12	140°	.5	Do.

Dredging and Hydrographic Records Secured in San

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Outside Golden Gate.					
D. 5731 H. 5035	Mile Rk. Lt., N. 71° E. Bonita Pt. Lt., N. 9° E. Lime Pt. Lt., N. 49° E.	*C. S.* 5532	1912. Mar. 11	9.47 a. m.	*fms.*16 *fms.* 9¾	crs. S., P., Sh.
D. 5732 H. 5036	Mile Rk. Lt., N. 75° E. Bonita Pt. Lt., N. 37° E. Lime Pt. Lt., N. 56½° E.	5532	do	10.31 a. m.	*fms.*11¾ *fms.* 9½	crs. S., G.
D. 5733 H. 5037	Bonita Pt. Lt., N. 46° E. Lime Pt. Lt., N. 58° E. Mile Rk. Lt., N. 72° E.	5532	do	11.06 a. m.	*fms.* 9 *fms.* 8	fne. dk. S.
D. 5734 H. 5038	Bonita Pt. Lt., N. 67° E. Lime Pt. Lt., N. 71° E. Mile Rk. Lt., N. 87° E.	5532	do	12.40 p. m.	*fms.* 7¾ *fms.* 9½	fne. gy. S.
D. 5735 H. 5039	Bonita Pt. Lt., N. 67° E. Lime Pt. Lt., N. 71° E. Mile Rk. Lt., E.	5532	do	1.27 p. m.	*fms.* 9¾ *fms.*10	do
D. 5736 H. 5040	Bonita Pt. Lt., N. 67° E. Lime Pt. Lt., N. 72° E. Mile Rk. Lt., S. 85½° E.	5532	do	2.11 p. m.	*fms.* 9¾ *fms.*10	do
D. 5737 H. 5041	Bonita Pt. Lt., N. 63½° E. Fort Pt. Lt., N. 81° E. Mile Rk. Lt., S. 83° E.	5532	do	2.46 p. m.	*fms.*10½ *fms.*13	do
	Middle section of bay.					
D. 5738 H. 5042	Mile Rk. Lt., S. 33° W. Bonita Lt., S. 87° W. Lime Pt. Lt., N. 47° E.	5532	Mar. 13	9.30 a. m.	*fms.*60 *fms.*23	R., sh. S.
D. 5739 H. 5043	Alcatraz Lt., S. 24½° W. Southampton Lt., N. 9° E. Blunt Pt., S. 71½° W.	5532	do	10.56 a. m.	*fms.*18 *fms.*22	S., s. M.
D. 5740 H. 5044	Alcatraz Lt., S. 69° W. Rt. Tang. Angel Id., N. 33° W. Rt. Tang. Goat Id., S. 35½° E.	5532	do	1.21 p. m.	*fms.* 7 *fms.* 5¾	fne. gy. S., gy.-gn. M.
D. 5741 H. 5045	Belvedere Pt., S. 52° W. Lft. Tang. Angel Id., S. 85° E. Rt. Tang. Bluff Pt., N. 10° E.	5532	Mar. 18	9.34 a. m.	*fms.*19¾ *fms.*18	crs. gy. S., Sh., St.
D. 5742 H. 5046	Belvedere Pt., S. 55° W. Rt. Tang. Bluff Pt., N. 30° W. Lft. Tang. Angel Id., N. 52½° W.	5532	do	10.02 a. m.	*fms.*20½ *fms.*20	crs. gy. S., Sh., St., bk. M.
D. 5743 H. 5047	Alcatraz Lt., S. 75½° W. Southampton Lt., N. 2° W. Rt. Tang. Goat Id., S. 42° E.	5532	do	10.50 a. m.	*fms.*10 *fms.*15½	m. S.
D. 5744 H. 5048	Alcatraz Lt., S. 82° W. Southampton Lt., N. 30° W. Rt. Tang. Goat Id. S. 15½° W.	5532	do	1.23 p. m.	*fms.* 5¼ *fms.* 5	s. M.
D. 5745 H. 5049	Alcatraz Lt., N. 75° W. Southampton Lt., N. 11° W. Lft. Tang. Goat Id., S. 80° E.	5532	do	3.12 p. m.	*fms.*14½ *fms.*12½	gy. S., blk. M., Sh.
D. 5746 H. 5050	Belvedere Pt., N. 84° W. Angel Id. Lt., S. 56° E. Lft. Tang. Angel Id., N. 59½° E.	5532	do	4.09 p. m.	*fms.*18 *fms.*18	gy. S., P., Sh., M.
D. 5747 H. 5051	Southampton Lt. to Rt. Tang. Red Rk., 74° 39′. Rt. Tang. Red Rk. to Brothers Lt., 53° 39′.	5532	Mar. 19	9.52 a. m.	*ft.* 4 *fms.* 5	dk. stk. M.
D. 5748 H. 5052	Tang. Pt. Chauncey to Rt. Tang. Red Rk., 64° 40′. Rt. Tang. Red Rk. to Brothers Lt., 27° 27′.	5532	do	10.34 a. m.	*ft.* 4 *fms.* 5	do
D. 5749 H. 5053	California Pt. to Rt. Tang. Red Rk., 50° 29′. Rt. Tang. Red Rk. to Pt. San Pedro, 55° 43′.	5532	do	11.13 a. m.	*ft.* 5 *fms.* 5	dk. stk. M., Sh.
	Sausalito		do			
D. 5750 H. 5054	Lft. Tang. Red Rk. to Brothers Lt., 46° 32′. Brothers Lt. to Lft. Tang. Sisters, 29° 54′.	5532	Mar. 20	10.12 a. m.	*ft.* 5 *fms.* 5	

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
50.5	50.00	......	....	....	9′ Ag.; m. b...	Surf. and botm.	10⅓	233°.......	0.8	Ebb.
51.5	50.00	......	....	....	9′ Ag.; 19″ dr..	...do....	17	248°.......	.8	Do.
52	51.00	......	....	....	9′ Ag.; m. b....	...do....	20	235°.......	1.0	Do.
54	51.00	......	....	....	.....do.........	...do....	18	61°........	.8	Flood.
54.5	51.00	......	....	....	.....do.........	...do....	14	92°........	.6	Do.
55	51.00	......	....	....	.....do.........	...do....	13½	68½°.......	.5	Do.
55	51.00	......	....	....	.....do.........	...do....	20	79½°.......	.6	Do.
53.5	50.00	......	....	....	9′ Ag.; m. b...	Surf. and botm.	9	228°.......	.8	Ebb.
51	50.00	......	....	....	5′ Tnr.; m. b...	...do....	15	178°.......	.4	Do.
51	50.00	......	....	....	.....do.........	...do....	29	16°........	.4	Do.
52.5	50.00	......	....	....	9′ Ag.; m. b....	...do....	4	26½°.......	.4	Flood.
53	50.00	......	....	....	.....do.........	...do....	11	3°.........	.4	Do.
54	51.00	......	....	....	.....do.........	...do....	6	150½°......	.4	Flood. Large quantity living worms, molluscs, and brittle stars. Bridle-stops parted.
61	52.00	......	....	....	.....do.........	...do....	15	288°.......	.5	Ebb. Quantities of worm tubes.
59	52.00	......	....	....	.....do.........	...do....	16	305½°......	.8	Do.
60	52.00	......	....	....	.....do.........	...do....	9	224°.......	.5	Do.
53	50.00	......	....	....	3′ Tnr.; 19″ dr.	...do....	14 7	352°.......	.27	Flood.
53	50.00	......	....	....	.....do.........	...do....	8 8	57°........	.25	Do.
53	50.00	......	....	....	.....do.........	...do....	21½ 14½	41°........	.7	Do.
....	.....	......	....	....	....	....	.....	....	.....	Material collected from piles of Ferry Bldg.
54.5	51.00	......	....	....	.....do.........	botm...	33 16	70°.......	.7	Flood.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.					
D. 5751 H. 5055	San Quentin Pt. to Lft. Tang. Red Rk., 60° 42′. Lft. Tang. Red Rk. to Brothers Lt., 47° 23′.	*C. S.* 5532	1912. Mar. 20	11.18 a. m.	*ft.* 4½ *fms.* 5	....
	Upper section of bay.					
D. 5752 H. 5056	Lft. Tang. Marin Id. to Lft. Tang. Red Rk., 49° 00′. Lft. Tang. Red Rk. to Lft. Tang. San Pablo Pt., 37° 02′.	5532	Mar. 20	1.03 p. m.	*ft.* 5 *fms.* 5½	bn.-gy. M.........
	Middle section of bay.					
D. 5753 H. 5057	Rt. Tang. Sister to Lft. Tang. San Quentin Pt., 73° 30′. Lft. Tang. San Quentin Pt. to California Pt. 33° 48′.	5532	Mar. 20	1.54 p. m.	*ft.* 6 *fms.* 5	bn.-gy. M.........
D. 5754 H. 5058	Southampton Lt. to Alcatraz Lt., 92° 56′. Alcatraz Lt. to Rt. Tang. Goat Id., 60° 23′.	5532	Mar. 25	10.16 a. m.	*fms.* 4½ *ft.* 3½	bn. M.............
D. 5755 H. 5059	Southampton Lt. to Alcatraz Lt., 78° 36′. Alcatraz Lt. to Ferry Bldg., 62° 09′.	5532	...do.....	1.34 a. m.	*fms.* 3½ *ft.* 5	m. S., Sh..........
D. 5756 H. 5060	Brothers Lt. to Lft. Tang. San Quentin Pt., 64° 38′. Lft. Tang. San Quentin Pt. to Bluff Pt., 78° 44′.	5532	Mar. 26	10.13 a. m.	*fms.* 4½ *fms.* 2	gy. M.............
	Upper section of bay.					
D. 5757 H. 5061	Rt. Sister Id. to Lft. Tang. Marin Id., 66° 56′. Lft. Tang. Marin Id. to Brothers Lt., 38° 03′.	5532	Mar. 26	11.08 a. m.	*fms.* 4 *ft.* 4½	m. S...............
D. 5758 H. 5062	Brothers Lt., 236°, 0.33 mile..	5532	...do.....	1.07 p. m.	*fms.* 2 *ft.* 4	gy. M..............
D. 5759 H. 5063	End of brickworks pier, indicated on chart.	5533	Apr. 1	12.45 p. m.	*fms.* 4 *fms.* 3½	dk. gy. stk. M.....
D. 5760 H. 5064	Pt. Edith Beacon, 84°, 1.65 miles.	5534	Apr. 2	9.06 a. m.	*fms.* 2¼ *ft.* 3	S., Mi.............
D. 5761 H. 5065	Pt. Edith Beacon, 230°, 0.4 mile.	5534	...do.....	9.55 a. m.	*fms.* 3 *fms.* 5	m. S...............
	Middle section of bay.					
D. 5762 H. 5066	Began 25 yds. off Pt. Stuart and along shore at distances of from 20–50 yds.; along south side of Angel Id.	5532	Apr. 3	....	*fms.* 3½ *fms.* 3¼	R..................
D. 5763 H. 5067	See chart. Stood up Raccoon St. at distances of from 25–50 yds. from shore.	5532	...do.....	....	*fms.* 2 *fms.* 5½	E. G ....

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.					Min.		Mi.	
50.5	52.00	......	......	......	3′ Tnr.; 19″ dr.	botm...	13 9	120°.......	0.6	Flood.
55	52.00	......	......	......	3′ Tnr.; 19″ dr.	botm...	3 2	140°.......	.2	Flood.
58	52.00	......	......	......	3′ Tnr.; 19″ dr.	botm...	1 2	299°.......	.1	Flood.
52	50.00	......	......	......	.....do.........	...do....	6 7	77°........	3.4	Ebb. Operations conducted from launch.
59.5	50.00	......	......	......	.....do.........	...do....	47 16½	332°.......	1.0	Flood. Operations conducted from launch.
62	50.00	......	......	......	.....do.........	...do....	7 5½	127°.......	.6	Ebb. Operations conducted from launch.
70	51.00	......	......	......	3′ Tnr.; 19″ dr.	botm...	12 9	56°........	.6	Ebb. Operations conducted from launch.
58	52.00	......	......	......	.....do.........	...do....	21 10	92°........	.7	Do.
56	53.00	......	......	......	.....do.........	...do....	110	1½° [a]...... 325° [b].....	2.7	Flood. Operations conducted from launch.
50	49.00	......	......	......	.....do.........	...do....	10 10	73°........	1.1	Flood and ebb. Operations conducted through change of tide from launch.
54	49.00	......	......	......	.....do.........	...do....	45 19	73°........	1.4	Do.
....	....	......	......	......	3′ Tnr.; 19″ dr.	botm...	....	130°.......	.8	Hauled twice on run, but before third haul, dr. was lost with 20 fms. line. Flood. Operations conducted from launch.
....	....	......	......	......	.....do.........	...do....	....	42°........	.5	Ebb and flood. Operations conducted through change of tide from launch. Places dredged are indicated on chart by black line. Entire run is indicated by dotted line. Dr. down twice on this run, then ran over in same direction. Dredged off sand beaches in only two places.

[a] For 0.9 mile.

[b] For 1.8 mile.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1912.		*Fms.*	
D.5764 H.5068	Pt. Campbell, 287°, 0.8 mile..	5532	Apr. 3	....	4¾ 2¼	E. G...............
D.5765 H.5069	Pt. Blunt, 84°, 120 yds.......	5532	...do.....	....	1¾ 2½	S.................
	Lower section of bay.					
D.5766 H.5070	In Alameda Channel, 3.87 miles from end of piers.	5532	Apr. 8	1.03 p. m.	3 4	gy. M.............
D.5767 H.5071	Goat Id. Lt., Ferry Bldg., 23° 57′. Ferry Bldg., Hunter's Pt., 79° 12′.	5532	Apr. 9	10.44 a. m.	3 1¼	m. S..............
D.5768 H.5072	Goat Id. Lt., Ferry Bldg., 22° 48′. Ferry Bldg., Pt. Avisadero, 75° 22′.	5532	...do.....	1.25 p. m.	3½ 1¼	hrd. Sh...........
	Middle section of bay.					
D.5769	Fort Pt. Lt., 19½°, 0.8 mile..	5532	Apr. 15	9.45 a. m.	3¼ 3	hrd. S?...........
D.5770 H.5073	Bonita Pt. Lt., 199½°, 0.25 mile.	5532	...do.....	10.37 a. m.	5 7½	R.................
D.5771 H.5074	Sausalito Pt., 169½°, 150 yds..	5532	...do.....	1.09 p. m.	3¼ ½	bn. M.............
D.5772 H.5075	Belvedere Pt., 123½°, 0.7 mile.	5532	...do.....	2.57 p. m.	1¼ 4½	sft. M............
D.5773 H.5076	Yellow Bluff, 154°, 0.44 mile..	5532	...do.....	3.55 p. m.	3½ 2¾	R., St............
D.5774 H.5077	Lime Pt. Lt., 68°, 200 yds....	5532	Apr. 16	9.45 a. m.	4½ 4¾	G., R.............
D.5775 H.5078	Pt. Cavallo, 263°, 25 yds.....	5532	...do.....	10.45 a. m.	7 4	R.................
D.5776 H.5079	Mile Rk. Lt., 276°, 1.12 miles.	5532	Apr. 17	9.48 a. m.	3½ 3¼	fne. gy. S., R......
D.5777 H.5080	Fort Pt. Lt., 241°, 140 yds...	5532	...do.....	10.44 a. m.	3½ 2¾	R.................
D.5778 H.5081	Fort Pt. Lt., 288½°, 0.32 mile..	5532	...do.....	11.00 a. m.	3½ 2¼	gy. S., St.........

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
......	......	......	......	......	3′ Tnr.; 19″ dr.	botm...	......	159°......	0.62	Ebb and flood. Operations conducted through change of tide from launch. Ran down on NE. and E. shore of Angel Id., 25-50 yds. off shore. Dr. down as indicated by black lines on chart.
......	......	......	......	......	...do...	...do...	......	288½°......	.48	Ebb and flood. Operations conducted through change of tide from launch. Ran along S. shore of Angel Id.; dr. down as indicated by black lines on chart.
63	55.00	......	......	......	3′ Tnr.; 19″ dr.	botm...	......	286°......	3.87	Flood. Operations conducted from launch.
52	52.50	......	......	......	...do...	...do...	33 28½	347°......	1.7	Ebb. Operations conducted from launch.
53.5	54.00	......	......	......	19″ dr......	...do...	14 12 9	44½° a...... 129½°. a 241°. a	3.00	Flood. Operations conducted from launch; beam trawl lost in beginning.
61.5	53.00	......	......	......	3′ Tnr.; 19″ dr.	botm...	6¾ 5	17°......	.48	Flood. Operations conducted from launch. No botm. samples taken.
61.5	53.00	......	......	......	...do...	...do...	29	86°......	1.2	Ebb. Along N. side Golden Gate. Both drs. caught frequently. Run with 3′ Tnr. over same ground May 8, 1912.
60	54.00	......	......	......	...do...	...do...	54 26½	313°......	1.45	Ebb. Operations conducted from launch.
57	53.00	......	......	......	...do...	...do...	20½ 9½	128°......	.7	Do.
57	53.00	......	......	......	...do...	...do...	14½ 7½	148°......	.38	Do.
59	55.00	......	......	......	...do...	...do...	16 16	264°......	.6	Flood. Operations conducted from launch. Stones covered with barnacles and bryozoas.
62	55.00	......	......	......	...do...	...do...	10 7	9°......	.25	Flood. Operations conducted from launch.
57	54.00	......	......	......	...do...	...do...	20 16	263½°......	.87	Do.
61	55.00	......	......	......	...do...	...do...	5 3½	112°......	.29	Do.
62	55.00	......	......	......	...do...	...do...	22½ 16	99½°......	.63	Do.

a For 1 mile.

Dredging and Hydrographic Records Secured in San

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Upper section of bay.	*C. S.*	1912.		*Fms.*	
H. 5082	Brothers Lt., S. 13½° E. Lft. Tang. Marin Ids., S. 51½° W. Rt. Tang. Sisters, N. 12° W.	5533	Apr. 23	10.55 a. m.	14½	M.
H. 5083	Brothers Lt., S. 27° W. Rt. Tang. Sisters, S. 69½° W. Pt. Pinole, N. 72° E.	5533	...do.....	11.40 a. m.	6	.....do.
H. 5084	Brothers Lt., S. 32½° W. Rt. Tang. Sisters, S. 55½° W. Pt. Pinole, S. 73½° E.	5533	...do.....	1.20 p. m.	6	.....do.
H. 5085	Lone Tree Whf., S. 84° E. Mare Id. Lt., N. 65° E. Pt. Pinole, S. 40° E.	5533	...do.....	1.55 p. m.	4¾	.....do.
H. 5086	Mare Id. Lt., N. 63° E. Lone Tree Whf., S. 37½° E. Selby Whf., S. 88° E.	5533	...do.....	2.35 p. m.	5	.....do.
H. 5087	Mare Id. Lt., N. 32° W. Oleum Whf., S. 32° W. Carquinez Lt., N. 56½° E.	5533	...do.....	3.10 p. m.	10	.....do.
H. 5088	Carquinez Lt., N. 55° W. Crockett Whf., S. 68½° E. Selby Whf., S. 64° W.	5533	...do.....	3.40 p. m.	14½	.....do.
	Lower section of bay.					
H. 5089	Ferry Bldg., N. 83° W. Goat Id. Lt., N. 8° E. Pt. Avisadero, S. 5° E.	5531	Apr. 26	10.03 a. m.	12	bk. S.
H. 5090	Goat Id. Lt., N. 23° W. Lft. Tang. Mission Rk., N. 84° W. Pt. Avisadero, S. 18° W.	5531	...do.....	10.37 a. m.	9¾	sft. M.
H. 5091	Shag Rk., S. 57° W. Goat Id. Lt., N. 16½° W. San Bruno Lt., S. 17½° W.	5531	...do.....	11.16 a. m.	9¾	.....do.
H. 5092	Shag Rk., N. 52½° W. San Bruno Lt., S. 17° W. Pt. Avisadero, N. 21° W.	5531	...do.....	11.47 a. m.	7	M.
H. 5093	San Bruno Lt., S. 40½° W. Shag Rk., N. 33° W. No. 2 Beacon, S. 29° E.	5531	...do.....	12.52 p. m.	4¾	.....do.
H. 5094	No. 2 Beacon, S. 27½° E. San Bruno Lt., S. 67½° W. Shag Rk., N. 34½° W.	5531	...do.....	1.17 p. m.	4¼	.....do.
H. 5095	No. 2 Beacon, S. 30½° E. San Bruno Lt., N. 89° W. Shag Rk., N. 29½° W.	5531	...do.....	1.40 p. m.	4¾	.....do.
H. 5096	No. 2 Beacon, S. 54° E. San Bruno Lt., N. 61½° W. Shag Rk., N. 26° W.	5531	...do.....	2.10 p. m.	6	.....do.
	Middle section of bay.					
H. 5097	Alcatraz Lt., S. 51° E. Lime Pt. Lt., S. 52½° W. Angel Id. Lt., N. 22½° E.	5532	Apr. 29	12.59 p. m.	10	hrd.
H. 5098	Alcatraz Lt., S. 28½° W. Pt. Blunt, N. 61° W. Southampton Lt., N. 10° E.	5532	...do.....	1.48 p. m.	23½	.....do.
H. 5099	Alcatraz Lt., S. 17½° W. Rt. Tang. Angel Id., N. 63° W. Southampton Lt., N. 20° E.	5532	...do.....	2.15 p. m.	16	.....do.
H. 5100	Southampton Lt., N. 64° E. Rt. Tang. Angel Id., S. 73° W. Rt. Tang. Red Rk., N. 11° W.	5532	...do.....	2.39 p. m.	7½	M.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
58	55.73	53.96	13.83	22.68	Tnr. cse.; Ek. bot.; 4′ inter.; #12, #20; Ek. smp.; Pr. m.	surf. and botm.	10	Against tide.	.....	Ebb, 3.03 knots per hr
60	55.43	54.81	16.17	....	.....do.........	...do....	10	...do.......	.....	Ebb, 2.09 knots per hr.
61.5	56.23	55.76	13.13	....	.....do.........	...do....	9	...do.......	.....	Ebb, 0.97 knot per hr.
59.5	56.23	55.96	....	8.09	.....do.........	...do....	10	...do.......	.....	Ebb, 0.52 knot per hr.
56.5	56.23	56.66	4.15	7.79	.....do.........	...do....	10	...do.......	.....	Ebb, 0.82 knot per hr.
56	56.03	55.91	3.75	9.71	.....do.........	...do....	20	...do.......	.....	Flood, 0.57 knot per hr.
59	56.23	55.91	3.25	9.03	.....do.........	...do....	10	...do.......	.....	Flood, 0.68 knot per hr.
54	55.33	52.86	25.85	29.06	Tnr. cse.: Ek. bot.; 4′ inter.; #12, #20; Ek. smp.; Pr. m.	surf. and botm.	10	Against tide.	.....	Ebb, 1.96 knots per hr. Cable out 8 fms.
54.5	54.63	53.71	26.55	27.79	.....do.........	...do....	9	...do.......	.....	Ebb, 1.91 knots per hr. Cable out 7 fms.
55	55.73	54.81	26.21	26.39	.....do.........	...do....	12	...do.......	.....	Ebb, 2.23 knots per hr. Cable out 8 fms.
56	55.73	55.36	24.85	....	.....do.........	...do....	8	...do.......	.....	Ebb. Cable out 5 fms.
56	55.73	56.86	....	27.01	.....do.........	...do....	12	...do.......	.....	Ebb, 1.46 knots per hr. Cable out 3 fms.
56	57.53	57.01	27.17	27.08	.....do.........	...do....	11	...do.......	.....	Ebb, 1.42 knots per hr. Cable out 3 fms.
56	57.23	57.01	27.17	....	.....do.........	...do....	9	...do.......	.....	Ebb, 1.59 knots per hr. Cable out 3 fms.
56	57.53	57.11	26.87	27.31	.....do.........	...do....	10	...do.......	.....	Ebb, 1.58 knots per hr. Cable out 3½ fms.
56	52.03	51.81	31.36	31.61	Tnr. cse.; Ek. bot.; 4′ inter.; #12, #20; Ek. smp.; Pr. m.	surf. and botm.	12	Against tide.	.....	Ebb, 0.54 knot per hr. Cable out 28 fms. Botm. too hard for penetration by sampler; no botm. sample taken. Net towed for 5 min.
56	53.23	51.86	30.02	31.16	.....do.........	...do....	13	...do.......	.....	Ebb, 0.79 knot per hr. Cable out 20 fms. Botm. too hard; no sample taken.
55	53.73	52.01	29.95	30.79	.....do.........	...do....	9	...do.......	.....	Ebb, 1.89 knots per hr. Cable out 13 fms. Botm. too hard; no sample taken.
54	54.23	52.86	28.56	29.56	.....do.........	...do....	21	...do.......	.....	Ebb, 1.76 knots per hr.; 2.23 knots at 3.15 p. m. Cable out 4½ fms.

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.					
		C. S.	1912.		*Fms.*	
H.5101	Rt. Tang. Red Rk., N. 5½° W. Lft. Tang. Bluff Pt., S. 47½° W. Southampton Lt., S. 69° E.	5532	Apr. 29	3.31 p. m.	12½	M
H.5102	Rt. Tang. Red Rk., N. 8° E. Lft. Tang. Bluff Pt., S. 8° W. Southampton Lt., S. 50° E.	5532	...do.....	4.00 p. m.	7¼	.....do
H.5103	Rt. Tang. Red Rk., S. 53½° E. Southampton Lt., S. 51° E. Brothers Lt., N. 16° E.	5532	...do.....	4.25 p. m.	8	hrd. M
H.5104	Rt. Tang. Red Rk., S. 62° E. Brothers Lt., N. 28° E. Southampton Lt., S. 36½° E.	5532	...do.....	4.54 p. m.	9	.....do
	Upper section of bay.					
H.5105	Brothers Lt., S. 4° E Lft. Tang. Marin Ids., S. 59½° W. Rt. Tang. Sisters, N. 27½° W.	5533	Apr. 30	9.49 a. m.	14	M
H.5106	Brothers Lt., S. 22° W. Rt. Tang. Sisters, S. 62½° W. Pt. Pinole, N. 71½° E.	5533	...do.....	10.13 a. m.	7	.....do
H.5107	Brothers Lt., S. 28° W. Rt. Tang. Sisters, S. 50° W. Pt. Pinole, S. 71° E.	5533	...do.....	10.41 a. m.	6¾	.....do
H.5108	Lone Tree Whf., S. 83½° E. Mare Id. Lt., N. 65° E. Pt. Pinole, S. 37° W.	5533	...do.....	11.18 a. m.	4	.....do
H.5109	Mare Id. Lt., N. 63° E. Lone Tree Whf., S. 43° E. Selby Whf., N. 89° E.	5533	...do.....	11.49 a. m.	6¼	.....do
H.5110	Mare Id. Lt., N. 44° W. Carquinez Lt., N. 40° E. Crockett Whf., S. 71° E.	5533	...do.....	12.42 p. m.	9¾	.....do
H.5111	Mare Id. Lt., N. 63° W. Selby Whf., S. 69° W. Crockett Whf., S. 67½° E.	5533	...do.....	1.07 p. m.	15	.....do
	Lower section of bay.					
H.5112	Goat Id. Lt., N. 19½° E. Ferry Bldg., N. 68° W. Pt. Avisadero, S. 11½° E.	5531	May 1	9.38 a. m.	14¾	S
H.5113	Goat Id. Lt., N. 14½° W. Lft. Tang. Mission Rk., N. 77½° W. Pt. Avisadero, S. 9½° W.	5531	...do.....	10.12 a. m.	10	M
H.5114	Shag Rk., S. 63° W. Goat Id. Lt., N. 18° W. San Bruno Lt., S. 20° W.	5531	...do.....	10.41 a. m.	9¾	.....do
H.5115	Shag Rk., N. 42° W. San Bruno Lt., S. 18½° W. Pt. Avisadero, N. 16½° W.	5531	...do.....	11.12 a. m.	7	.....do
H.5116	San Bruno Lt., S. 40° W. Shag Rk., N. 38° W. No. 2 Beacon, S. 28° E.	5531	...do.....	11.38 a. m.	5	.....do
H.5117	Shag Rk., N. 31° W. No. 2 Beacon, S. 30½° E. San Bruno Lt., S. 69° W.	5531	...do.....	12.05 p. m.	5¼	.....do
H.5118	No. 2. Beacon, S. 30° E. Shag Rk., N. 32° W. San Bruno Lt., N. 88° W.	5531	...do.....	12.29 p. m.	5	.....do
H.5119	No. 2 Beacon, S. 36½° E. San Bruno Lt., N. 63° W. Shag Rk., N. 28° W.	5531	...do.....	1.00 p. m.	4¾	.....do
	Middle section of bay.					
H.5120	Angel Id. Lt., N. 12° E. Alcatraz Lt., S. 48½° E. Lime Pt. Lt., S. 55½° W.	5532	May 6	11.09 a. m.	11¾	hrd

FRANCISCO BAY, CALIF., 1912-13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
53	54.23	52.81	26.71	29.89	Tnr. cse.; Ek. bot.; 4′ inter.; #12, #20; Ek. smp.; Pr. m.	surf. and botm.	13	Against tide.	.....	Ebb, 2.36 knots per hr. Cable out 10 fms.
54	54.83	53.81	25.30	27.48	.....do.........	...do....	12	...do......	.....	Ebb, 2.49 knots per hr. Cable out 5 fms.
54.5	55.53	54.11	23.31	26.39	.....do.........	...do....	7	...do......	.....	Ebb, 2.41 knots per hr. Cable out 5½ fms.
55	55.53	55.26	22.29	23.64	.....do.........	...do....	10	...do......	.....	Ebb, 2.14 knots per hr. Cable out 7 fms.
57.5	55.63	54.86	19.75	23.29	Tnr. cse.; Ek. bot.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	10	Against tide.	.....	Flood, 2.05 knots per hr. Cable out 11 fms.
58	55.63	55.01	19.96	22.05	.....do.........	...do....	10	...do......	.....	Flood, 2.52 knots per hr. Cable out 8 fms.
57	56.03	55.06	18.95	21.89	.....do.........	...do....	12	...do......	.....	Flood, 2.47 knots per hr. Cable out 7 fms.
57.5	56.03	55.91	17.08	17.22	.....do.........	...do....	11	...do......	.....	Flood, 1.71 knots per hr. Cable out 3½ fms.
58.5	56.93	56.56	14.00	14.00	.....do.........	...do....	10	...do......	.....	Flood, 1.64 knots per hr. (at surf.), 1.37 per hr. (at botm.). Cable out 4 fms.
59	56.73	56.81	12.45	14.29	.....do.........	...do....	7	...do......	.....	Flood, 1.10 knots per hr. Cable out 7 fms.
59	57.63	56.96	9.96	13.35	.....do.........	...do....	13	...do......	.....	Flood, 0.88 knot per hr. Cable out 10 fms.
55	54.73	54.71	26.58	27.89	Tnr. cse.; Ek. bot.; 4′ inter; #12, #20; Pr. m.	surf. and botm.	14	Against tide.	.....	Flood, 2.90 knots per hr. Cable out 12 to 14 fms.
55	54.93	54.86	27.33	27.85	.....do.........	...do....	15	...do......	.....	Flood, 1.59 knots per hr. Cable out 8 fms.
57	55.53	55.56	27.26	27.79	.....do.........	...do....	15	...do......	.....	Flood, 2.41 knots per hr. Cable out 7 fms.
58	55.73	55.86	27.01	27.01	.....do.........	...do....	11	...do......	.....	Flood, 1.64 knots per hr. Cable out 5 fms.
58	56.53	56.76	27.17	27.01	.....do.........	...do....	11	...do......	.....	Flood, 0.85 knot per hr. Cable out 3-2 fms.
58	57.63	57.71	27.01	27.01	.....do.........	...do....	10	...do......	.....	Flood, 0.63 knot per hr. Cable out 3 fms.
56.5	57.63	57.71	26.87	27.01	.....do.........	...do....	12	...do......	.....	Flood, 0.48 knot per hr. Cable out 3 fms.
55	57.33	57.06	26.87	26.78	.....do.........	...do....	10	...do......	.....	Do.
57	56.33	55.16	26.55	27.79	Tnr. cse.; Ek. bot.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	30	Against tide.	.....	Flood, 0.54 knot per hr. Cable out 9 fms.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.					
		C. S.	1912.		*Fms.*	
H. 5121	Alcatraz Lt., S. 25½° W Blunt Pt., N. 54° W. Southampton Lt., N. 12° E.	5532	May 6	11.38 a. m.	24½	hrd. M
H. 5122	Alcatraz Lt., S. 19° W Rt. Tang. Angel Id., S. 47° W.	5532	...do.....	12.29 p. m.	17	S., M
H. 5123	Southampton Lt., N. 70° E Rt. Tang. Red Rk., N. 12° W. Rt. Tang. Angel Id., S. 65° W.	5532	...do.....	12.59 p. m.	8	M
H. 5124	Rt. Tang. Red Rk., N. 7° W Lft. Tang. Bluff Pt., S. 39° W. Southampton Lt., S. 61° E.	5532	...do.....	1.26 p m.	14	.....do
H. 5125	Rt. Tang. Red Rk., N. 8½° E Lft. Tang. Bluff Pt., S. 6° W. Southampton Lt., S. 49° E.	5532	...do.....	1.51 p. m.	7½	hrd
H. 5126	Brothers Lt., N. 12½° E Rt. Tang. Red Rk., N. 52° E. Southampton Lt., S. 46° E.	5532	...do.....	2.15 p. m.	7½	hrd. M
H. 5127	Brothers Lt., N. 28½° E Rt. Tang. Red Rk., S. 55° E. Southampton Lt., S. 35° E.	5532	...do.....	2.44 p. m.	9	.....do
D. 5779	Alcatraz Lt., 51°, 1.83 miles	5532	May 8	9.36 a. m.	3 3	gy. S., R
	Upper section of bay.					
D. 5780	Pt. Pinole, S. 43° E Mare Id. Lt., N. 66° E. Brothers Lt., S. 32½° W.	5533	May 13	12.40 p. m.	5 1	gy. M., Sh
	Middle section of bay.					
H. 5128	Alcatraz Lt., S. 44° E Lime Pt. Lt., S. 64° W. Angel Id. Lt., N. 6° W.	5532	May 14	7.00 a. m.	15	
	.....do	5532	...do.....	7.55 a. m.	15	
	.....do	5532	...do.....	8.55 a. m.	15	
	.....do	5532	...do.....	9.55 a. m.	15	
	.....do	5532	...do.....	10.55 a. m.	15	
	.....do	5532	...do.....	11.55 a. m.	15	
	.....do	5532	...do.....	12.55 p. m.	15	
	.....do	5532	...do.....	1.55 p. m.	15	
	.....do	5532	...do.....	2.55 p. m.	15	
	.....do	5532	...do.....	3.55 p. m.	15	
	.....do	5532	...do.....	4.55 p. m.	15	
	.....do	5532	...do.....	5.55 p. m.	15	
H.5129A	Southampton Lt., 321°, 2¼ miles.	5532	May 15		4½	
H.5129B	Southampton Lt., 309½°, 2.7 miles	5532	...do.....		3	
H.5129C	Berkeley Pier, 61°, 0.88 mile	5532	...do.....		2	
H.5129D	Berkeley Pier, 283°, 0.43 mile.	5532	...do.....		3½	
	Lower section of bay.					
D. 5781	San Bruno Lt., N. 61° W Shag Rk., N. 16° W. No. 2 Beacon, S. 47° E.	5531	May 27	12.27 p. m.	2½ ½	M., Sh
D. 5782	San Bruno Lt., N. 50° W San Mateo Pt., S. 86° W. No. 2 Beacon, S. 70° E.	5531	...do.....	3.00 p. m.	⅔ ⅔	Sh

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
56	56.13	54.61	22.99	....	Tnr. cse.; Ek. bot.; 4′ inter.; #12; #20; Pr. m.	surf. and botm.	17	Against tide.	. . .	Flood, 0.36 knot per hr. Cable out 20 fms.
55	58.33	54.16	20.82	28.88	do	do	10	do	.....	Flood, 0.45 knot per hr. Cable out 13 fms.
58	58.63	54.71	19.70	28.88	do	do	14	do	.....	Flood, 0.13 knot per hr. Cable out 4½ fms.
58	57.13	55.41	18.34	27.33	do	do	10	do	.....	Flood, 1.33 knots per hr. Cable out 10 fms.
60	58.03	55.61	21.60	27.21	do	do	8	do	.....	Flood, 1.51 knots per hr. Cable out 5 fms.
60	57.03	55.71	23.08	27.33	do	do	11	do	.....	Flood, 1.53 knots per hr. Cable out 5 fms.
57	57.73	55.81	20.66	26.55	do	do	14	do	.....	Flood, 1.19 knots per hr. Cable out 7-4-6½ fms.
58.5	54.00	......	....	....	3′ Tnr.; 19″ dr.	botm...	27 20	82°........	1.8	Flood. Operations conducted from launch.
67	62.00	......	....	....	3′ Tnr.; 19″ dr.	botm...	73	316°.......	4.2	Ebb. Operations conducted from launch.
55	52.63	54.41	26.91	29.50	Ek. bot.; 4′ inter.; Tnr. cse.; #12, #20; Pr. m.	surf. and botm.	10	Against tide.	.....	Flood, 1.33 knots per hr.
59	54.03	53.96	28.79	29.34	do	do	10	do	.....	Flood, 2.63 knots per hr.
61	53.83	53.81	29.50	30.11	do	do	10	do	.....	Flood, 2.27 knots per hr.
61	53.73	53.81	30.28	30.37	do	do	10	do	....	Flood, 2 knots per hr.
57	53.63	53.71	29.80	30.59	do	do	10	do	.....	Flood, 1.33 knots per hr.
57	54.23	54.66	29.65	30.63	do	do	10	do	.....	Flood, 0.40 knot per hr.
58	54.73	53.81	28.79	30.28	do	do	10	do	.....	Ebb, 1.59 knots per hr.
56	56.03	53.86	27.33	28.47	do	do	10	do	.....	Ebb, 2 knots per hr.
59	56.03	54.26	26.67	29.65	do	do	10	do	.....	Ebb, 2.23 knots per hr.
59	57.53	54.16	25.92	28.88	do	do	10	do	.....	Ebb, 1.55 knots per hr.
59	57.53	54.86	25.46	28.72	do	do	10	do	.....	Ebb, 1.01 knots per hr.
59	57.53	55.21	25.00	28.56	do	do	10	do	.....	Flood, 0.66 knot per hr.
....	.....	......	....	....	Ek. smp.......	botm...	....	....	.....	Ebb. Operations conducted from launch.
....	.....	......	....	....	do	do	....	....	.....	Do.
....	.....	......	....	....	do	do	....	....	.....	Do.
....	.....	......	....	....	do	do	....	....	.....	Do.
61	61.00	......	....	....	19″ dr.........	botm...	47	230°.......	1.85	Ebb. Operations conducted from launch.
60	61.00	......	....	....	do	do	2	Circle.....	.3	Ebb. Operations conducted from launch. Made a circle in oyster bed and finished at starting pt.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.	*C. S.*	1912.		*Fms.*	
D.5783	San Mateo Pt., S. 70° W., 2.67 miles.	5531	May 28	12.36 p. m.	2 2	
D.5784	No. 2 Beacon, S. 36½° W., 0.95 mile.	5531	do.		1½ 1¾	
	Middle section of bay.					
	Bonita Pt.		June 3			
	Halfway between Sausalito and Angel Id.		do.	1.30 p. m.		
	Halfway between Angel Id. and Southampton Lt.		do.	2.30 p. m.		
	Halfway between Sausalito and Angel Id.		June 10	1.20 p. m.		
	Halfway between Angel Id. and Southampton Lt.		do.	2.25 p. m.		
	Halfway between Sausalito and Angel Id.		June 14	9.45 a. m.		
	Halfway between Angel Id. and Southampton Lt.		do.	10.45 a. m.		
	Halfway between Sausalito and Angel Id.		June 17	2.00 p. m.		
	Halfway between Angel Id. and Southampton Lt.		do.	3.00 p. m.		
	Halfway between Sausalito and Angel Id.		June 24	2.00 p. m.		
	Halfway between Angel Id. and Southampton Lt.		do.	3.00 p. m.		
	Halfway between Sausalito and Angel Id.		June 27	2.00 p. m.		
	do.		June 29	2.00 p. m.		
	Halfway between Angel Id. and Southampton Lt.		July 6	10.00 a. m.		
	Halfway between Sausalito and Angel Island.		do.	11.30 a. m.		
	Off Golden Gate.		July 8		28 30	S.
	Halfway between Sausalito and Angel Id.		July 14	9.45 p. m.		
	Halfway between Angel Id. and Southampton Lt.		do.	10.25 p. m.		
	Off Golden Gate.		July 21		28 30	S.
H.5130	Lime Pt. Lt., S. 58° W. Alcatraz Lt., S. 54° E. Angel Id. Lt., N. 16½° E.	5532	July 22	9.29 a. m.	13	hrd. S.
H.5131	Southampton Lt., N. 14° E. Alcatraz Lt., S. 24° W. Blunt Pt., N. 49° W.	5532	do.	10.04 a. m.	25	do.
H.5132	Southampton Lt., N. 11° E. Rt. Tang. Angel Id., N. 53° W. Lft. Tang. Angel Id., S. 54½° W.	5532	do.	10.49 a. m.	19	do.
H.5133	Rt. Tang. Angel Id., S. 82° W. Rt. Tang. Red Rk., N. 14° W. Southampton Lt., N. 51° E.	5532	do.	11.20 a. m.	9½	do.
H.5134	Rt. Tang. Red Rk., N. 4° W. Lft. Tang. Bluff Pt., S. 56° W. Southampton Lt., S. 75° E.	5532	do.	11.49 a. m.	11½	S.
H.5135	Rt. Tang. Red Rk., N. 2° E. Southampton Lt., S. 49½° E. Lft. Tang. Bluff Pt., S. 13½° W.	5532	do.	1.01 p. m.	8	M.
H.5136	Rt. Tang. Red Rk., N. 59° E. Southampton Lt., S. 47° E. Brothers Lt., N. 14° E.	5532	do.	1.30 p. m.	7½	do.
H.5137	Rt. Tang. Red Rk., S. 65½° E. Brothers Lt., N. 26° E. Southampton Lt., S. 36° E.	5532	do.	2.02 p. m.	8	hrd. S.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
68	63.00	......	......	......	19″ dr.	botm.	31	S. 54° E.	2.35	Ebb. Operations conducted from launch.
....	....	......	......	......	do.	do.	......	N. 59° E.	2.5	Do.
....	....	......	......	......	......	......	......	......	.....	On piles between high and low tides.
....	....	......	......	......	4′ inter.; #12, #20.	surf.	30	Against tide.	.....	
....	....	......	......	......	do.	do.	30	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	30	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	do.	do.	20	do.	.....	
....	....	......	......	......	seine.	botm.	95	......	6.0	Trip made with Paladini Fish Co.; 4 hauls.
....	....	......	......	......	4′ inter.; #12, #20.	surf.	20	Against tide.	.....	
....	....	......	......	......	do.	do.	25	do.	.....	
....	....	......	......	......	seine.	botm.	90	......	6.0	Trip made with Paladini Fish Co.; 3 hauls.
57	57.73	57.71	31.05	31.36	Tnr. cse.; 4′ inter.; #12, #20; Ek. bot.	surf. and botm.	15	Against tide.	.....	Ebb. After getting under way net was towed 5 min.
57	60.73	57.86	29.47	31.10	do.	do.	14	do.	.....	Ebb. Cable out 10 fms., towed 5 min.
59	60.23	58.11	30.11	31.05	do.	do.	11	do.	.....	Ebb. Cable out 20 fms., towed 5 min. at 10 fms.
59	62.73	58.56	27.54	30.98	do.	do.	12½	do.	.....	Ebb. Cable out 15 fms., towed 4 min.
66	64.63	58.56	24.39	30.33	do.	do.	18	do.	.....	Ebb. Cable out 16 fms., towed 8 min.
66	64.73	60.36	28.07	28.88	do.	do.	16	do.	.....	Ebb. Cable out 5–10 fms., towed 6 min.
67.5	64.13	60.86	27.21	28.79	do.	do.	17	do.	.....	Ebb. Towed 2 min.
69	63.73	60.86	25.49	28.56	do.	do.	18½	do.	.....	Ebb. Towed 8½ min.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay.	*C. S.*	1912.		*Fms.*	
H. 5138	Goat Id. Lt., N. 23° E Ferry Bldg., N. 81° W. Rt. Tang. Mission Rk., N. 34½° W.	5531	July 23	10.03 a. m.	12	M
H. 5139	Goat Id. Lt., N. 17° W Ferry Bldg., N. 56° W. Rt. Tang. Mission Rk., N. 86° W.	5531	...do	10.36 a. m.	12	.....do
H. 5140	Goat Id. Lt., N. 16° W Shag Rk., S. 63½° W. San Bruno Lt., S. 17° W.	5531	...do	11.15 a. m.	9	.....do
H. 5141	Shag Rk., N. 52° W Candlestick Pt., N. 72° W. San Bruno Lt., S. 22° W.	5531	...do	11.54 a. m.	6½	.....do
H. 5142	Shag Rk., N. 36° W San Bruno Lt., S. 39½° W. No. 2 Beacon, S. 28° E.	5531	...do	1.02 p.m.	5¾	.....do
H. 5143	San Bruno Lt., S. 66° W No. 2 Beacon, S. 32° E. Shag Rk., N. 31½° W.	5531	...do	1.29 p. m.	5	sft. M
H. 5144	San Bruno Lt., W No. 2 Beacon, S. 31° E. Pt. Avisadero, N. 19° W.	5531	...do	1.57 p. m.	5	.....do
H. 5145	San Bruno Lt., N. 71° W No. 2 Beacon, S. 33° E. San Mateo Pt., S. 10° W.	5531	...do	2.28 p. m.	6½	M
	Upper section of bay.					
H. 5146	Brothers Lt., S. 2° W Lft. Tang. Sisters, N. 36° W. Pinole Pt., N. 58° E.	5533	July 24	10.08 a. m.	14	M
	.....do	5533	...do	11.01 a. m.		
	.....do	5533	...do	11.49 a. m.		
	.....do	5533	...do	12.51 p. m.		
H. 5147	Brothers Lt., S. 27° W Pinole Pt., S. 73° E. Rt. Tang. Sisters, S. 49° W.	5533	...do	1.39 p. m.	6½	M
H. 5148	Mare Id. Lt., N. 64° E Lone Tree Whf., S. 39½° E. Pinole Pt., S. 50° W.	5533	...do	2.44 p. m.	6	.....do
H. 5149	Carquinez Lt., N. 45° W Lft. Tang. Crockett Whf., S. 72° E. Rt. Tang. Selby Whf., S. 60½° W.	5533	...do	3.32 p. m.	13	hrd
	Middle section of bay.					
H. 5150	Rt. Tang. Red Rk., N. 62° E Brothers Lt., N. 18½° E. Lft. Tang. Sisters, N. 2° E.	5532	July 29	9.05 a. m.	8½	M
H. 5151	Rt. Tang. Red Rk., N. 65° E Brothers Lt., N. 15½° E. Southampton Lt., S. 46° E.	5532	...do	9.28 a. m.	7½	.....do
H. 5152	Rt. Tang. Red Rk., N. 9½° E Southampton Lt., S. 52° E. Bluff Pt., S. 8½° W.	5532	...do	9.52 a. m.	7½	.....do
H. 5153	Bluff Pt., S. 45° W Southampton Lt., S. 59° E. Rt. Tang. Red Rk., N. 9° W.	5532	...do	10.16 a. m.	7½	.....do
H. 5154	Southampton Lt., N. 75° W Rt. Tang. Angel Id., S. 63° W. Rt. Tang. Red Rk., N. 15½° W.	5532	...do	10.39 a. m.	8½	hrd. S
H. 5155	Southampton Lt., N. 12½° E Rt. Tang. Angel Id., N. 72° W. Lft. Tang. Angel Id., S. 40° W.	5532	...do	11.02 a. m.	13	.....do
H. 5156	Southampton Lt., N. 8° E Alcatraz Lt., S. 28° W. Blunt Pt., N. 83° W.	5532	...do	11.22 a. m.	16	m. S

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
61	62.63	59.11	28.14	30.37	Trn. cse.; 4′ inter.; #12, #20; Ek. bot.	surf. and botm.	16	Against tide.	.....	Ebb. Cable out 9 fms., towed 5 min.
61	62.73	60.86	28.47	29.34	.....do.........	...do....	18	...do......	.....	Ebb. Cable out 9 fms., towed 6 min. Nets filled with sand. Haul discarded.
61.5	63.23	62.21	28.26	28.74	.....do.........	...do....	18	...do......	.....	Ebb. Cable out 6–8–10 fms., because of small ebb; after getting under way towed 5 min.
63	64.73	62.86	27.98	28.23	.....do.........	...do....	19	...do......	.....	Ebb. Cable out 4–10 fms., towed 5 min.
63	65.53	63.71	27.68	27.98	.....do.........	...do....	17½	...do......	.....	Ebb. Cable out 3 fms., towed 5 m.
63.5	65.23	64.86	27.70	27.59	.....do.........	...do....	20	...do......	.....	Ebb. Cable out 3 fms., towed 4 m.
64	65.33	64.86	27.74	27.68	.....do.........	...do....	20	...do......	.....	Ebb. Cable out 3 fms., towed 5 m.
64	65.93	65.66	27.40	27.45	.....do.........	...do....	18	...do......	.....	Ebb. Cable out 3½ fms., towed 5 m.
66	63.23	61.36	25.18	28.35	Trn. cse.; 4′ inter.; #12, #20; Ek. bot.	surf. and botm.	......	....	.....	Flood.
69	63.03	61.06	25.77	28.62	.....do.........	...do....	......	....	.....	Do.
69.5	65.03	60.96	25.39	28.79	.....do.........	...do....	......	....	.....	Slack.
69.5	63.23	......	26.39	28.79	.....do.........	...do....	18	Against tide.	.....	Ebb. Cable out 10 fms., towed 5 m.
68.5	64.53	62.86	25.39	26.23	.....do.........	...do....	16	...do......	.....	Ebb. Cable out 3–10 fms., towed 4 m.
69	67.23	65.06	18.60	22.07	.....do.........	...do....	18	...do......	.....	Ebb. Cable out 4–16 fms., towed 5 m.
69	66.73	66.01	15.16	18.63	.....do.........	...do....	16	...do......	.....	Ebb. Cable out 10 fms., towed 5 m.
57	64.33	62.86	22.32	26.49	Trn. cse.; 4′ inter.; #12; #20; Ek. bot.	surf. and botm.	11	Against tide.	.....	Flood. Cable out 6 fms.
57	63.73	62.91	25.77	26.54	.....do.........	...do....	11½	...do......	.....	Do.
57	62.73	62.86	26.39	26.39	.....do.........	...do....	11	...do......	.....	Flood. Cable out 5 fms.
57	61.73	60.11	27.65	29.43	.....do.........	...do....	11	...do......	.....	Do.
57.5	62.03	60.16	27.30	29.56	.....do.........	...do....	11	...do......	.....	Flood. Cable out 6 fms.
58	60.43	58.81	28.95	30.50	.....do.........	...do....	11	...do......	.....	Flood. Cable out 12 fms.
58	58.23	58.01	30.96	30.98	.....do.........	...do....	11½	...do......	.....	Flood. Cable out 13–15 fms.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1912.		*Fms.*	
H. 5157	Alcatraz Lt., S. 46° E. Angel Id. Lt., N. 8° E. Lime Pt. Lt., S. 55° W.	5532	July 29	12.01 p. m.	13	hrd. S.
	Lower section of bay.					
H. 5158	San Bruno Lt., N. 65° W. No. 2 Beacon, S. 36° E. San Mateo Pt., S. 15½° W.	5531	July 30	8.53 a. m.	6	sft. M.
H. 5159	San Bruno Lt., N. 85° W. No. 2 Beacon, S. 32° E. Pt. Avisadero, N. 23° W.	5531	...do...	9.20 a. m.	5	...do...
H. 5160	San Bruno Lt., S. 69½° W. No. 2 Beacon, S. 30° E. Shag Rk., N. 33° W.	5531	...do...	9.43 a. m.	4¾	M.
H. 5161	Shag Rk., N. 35° W. San Bruno Lt., S. 43° W.	5531	...do...	10.08 a. m.	5	...do...
H. 5162	Shag Rk., N. 47° W. San Bruno Lt., S. 18° W. Candlestick Pt., N. 72° W.	5531	...do...	10.38 a. m.	6¾	hrd. M.
H. 5163	Goat Id. Lt., N. 21° W. Shag Rk., S. 60° W. San Bruno Lt., S. 19° W.	5531	...do...	11.10 a. m.	8	M.
H. 5164	Goat Id. Lt., N. 18½° W. Ferry Bldg., N. 50° W. Rt. Tang. Mission Rk., N. 83° W.	5531	...do...	11.46 a. m.	10	...do...
H. 5165	Goat Id. Lt., N. 27° W. Ferry Bldg., N. 67° W. Rt. Tang. Mission Rk., S. 26½° E.	5531	...do...	12.26 p. m.	12½	...do...
	Upper section of bay.					
H. 5166	Carquinez Lt., N. 34° W. Lft. Tang. Crockett Whf., S. 79° E. Rt. Tang. Selby Whf., S. 66° W.	5533	July 31	11.58 a. m.	10½	gy. S.
H. 5167	Mare Id. Lt., N. 53½° W. Carquinez Lt., N. 43° E. Lone Tree Whf., S. 35½° W.	5533	...do...	12.19 p. m.	7	M.
H. 5168	Mare Id. Lt., N. 60° E. Lone Tree Whf., S. 40½° E. Pinole Pt., S. 53° W.	5533	...do...	12.57 p. m.	6	...do...
H. 5169	Lone Tree Whf., S. 83½° E. Pinole Pt., S. 35½° W. Mare Id. Lt., N. 67° E.	5533	...do...	1.30 p. m.	5	...do...
H. 5170	Brothers Lt., S. 30° W. Rt. Tang. Sisters, S. 53° W. Pinole Pt., S. 73° E.	5533	...do...	2.21 p. m.	7	...do...
H. 5171	Pinole Pt., N. 74½° E. Brothers Lt., S. 26° W. Rt. Tang. Sisters, S. 63° W.	5533	...do...	2.48 p. m.	6¼	...do...
H. 5172	Rt. Tang. Marin Ids., S. 65½° W. Lft. Tang. Sisters, N. 41½° E. Brothers Lt., S.	5533	...do...	3.21 p. m.	13	...do...
	Middle section of bay.					
....	Bonita Pt.	....	Aug. 1	....	....	....
....	Presidio shore (west of Fort Pt.).	....	...do...	....	....	....
....	Key Route Pier (mud flats north of).	....	Aug. 2	....	....	....
....	Key Route Pier (cement sewer).	....	...do...	....	....	....
....	Red Rk.	....	Aug. 3	....	....	....
....	Richmond (Standard Oil Pier).	....	...do...	....	....	....
....	Halfway between Angel Id. and Southampton Lt.	....	Aug. 21	9.10 a. m.	....	....
....	...do...	....	...do...	10.10 a. m.	....	....
....	300 yds. SE. Pt. Diablo.	....	Aug. 30	2.00 p. m.	....	....
....	Between Angel Id. and Sausalito.	....	Sept. 6	9.30 a. m.	....	....

Francisco Bay, Calif., 1912–13, and March, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
58	56.63	56.71	31.79	31.90	Trn. cse.; 4′ inter.; #12, #20; Ek. bot.	surf. and botm.	12½	Against tide.	.....	Flood. Cable out 11 fms.
60	66.83	66.86	27.85	27.87	Trn. cse.; 4′ inter.; #12, #20; Ek. bot.	surf. and botm.	12	Against tide.	.....	Flood. Cable out 4 fms.
61.5	66.53	66.76	27.91	27.82	.....do.........	...do....	12	...do.......	.....	Flood. Cable out 4½ fms.
62	65.73	65.81	27.94	27.87	.....do.........	...do....	9	...do.......	.....	Flood. Cable out 3½ fms.
63	64.03	63.91	28.33	28.33	.....do.........	...do....	8½	...do.......	.....	Do.
63.5	63.83	62.71	28.49	28.79	.....do.........	...do....	10	...do.......	.....	Flood. Cable out 4 fms.
64	63.33	63.31	28.51	28.64	.....do.........	...do....	10½	...do.......	.....	Flood. Cable out 6 fms.
65.5	61.73	61.56	29.10	29.18	.....do.........	...do....	8	...do.......	.....	Flood. Cable out 8 fms.
65.5	60.63	58.81	30.11	30.83	.....do.........	...do....	11	...do.......	.....	Flood. Cable out 10 fms.
65	65.03	65.71	9.96	12.89	Trn. cse.; 4′ inter.; #12, #20; Ek. bot.	surf. and botm.	19½	Against tide.	.....	Flood. Cable out 8–11 fms., towed 9½ min. under way. Surf. 10 min. later because therm. did not trip.
65	65.23	65.36	11.35	16.11	.....do.........	...do....	14	...do......	.....	Flood. Cable out 11 fms., towed 3 min. under way.
67	65.53	65.56	16.63	16.94	.....do.........	...do....	10	...do......	.....	Flood. Cable out 4 fms.
66	65.03	64.86	21.91	22.05	.....do.........	...do....	10	...do......	.....	Flood. Cable out 6 fms.
64.5	63.73	62.91	24.85	25.94	.....do.........	...do....	11	...do......	.....	Flood. Cable out 5 fms.
64	62.93	62.41	26.47	27.01	.....do.........	...do....	11½	...do......	.....	Do.
64	62.73	60.56	28.25	29.23	.....do.........	...do....	10½	...do......	.....	Do.
....	.....	......	......	......	....	....	....	....	.....	On piles between high and low tides.
....	.....	......	......	......	....	....	....	....	.....	On beach between high and low tides.
....	.....	......	......	......	....	....	....	....	.....	Between high and low tides.
....	.....	......	......	......	....	....	....	....	.....	Do.
....	.....	......	......	......	....	....	....	....	.....	Do.
....	.....	......	......	......	....	....	....	....	.....	Do.
....	.....	......	......	......	4′ inter.; #12, #20.	surf....	30	Against tide.	.....	
....	.....	......	......	......	.....do.........	...do....	30	...do......	.....	
....	.....	......	......	......	.....do.........	...do....	30	...do......	.....	
....	.....	......	......	......	.....do.........	...do....	25	...do......	.....	

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.					
		C. S.	1912.		*Fms.*	
....	Off Golden Gate........	....	Sept. 9	....	28 30	S............
....	Between Angel Id. and Sausalito.	....	Sept. 12	1.30 p. m.	....	....
....	Off Golden Gate........	....	Sept. 17	....	28 30	S............
....	Between Angel Id. and Sausalito.	....	Sept. 19	1.30 p. m.	....	....
....	.....do........	....	Sept. 25	8.45 a. m.	....	....
....	Off Golden Gate........	....	Oct. 2	....	28 30	S............
	Upper section of bay.					
H. 5173	Brothers Lt., S. 1° E........ Lft. Tang. Marin Ids., N. 48° W. Lft. Tang. Sisters, S. 56½° W.	5533	Oct. 7	10.15 a. m.	12¾	M............
	.....do........	5533	...do.....	11.15 a. m.	....	....
	.....do........	5533	...do.....	12.30 p. m.	....	....
H. 5174	Brothers Lt., S. 24½° W...... Pinole Pt., N. 74° E. Rt. Tang. Sisters, S. 64° W.	5533	...do.....	1.15 p. m.	6½	M............
H. 5175	Brothers Lt., S. 33° W....... Rt. Tang. Sisters, S. 56½° W. Pinole Pt., S. 76½° E.	5533	...do.....	1.35 p. m.	7	.....do........
H. 5176	Lone Tree Pt., S. 83½° E..... Pinole Pt., S. 36½° W. Mare Id. Lt., N. 66° E.	5533	...do.....	2.23 p. m.	5	.....do........
H. 5177	Lone Tree Whf., S. 45° E.... Pinole Pt., S. 52° W. Mare Id. Lt., N. 62° E.	5533	...do.....	3.07 p. m.	6	.....do........
H. 5178	Mare Id. Lt., N. 40° W...... Carquinez Lt., N. 59½° E. Crockett Whf., S. 71° E.	5533	...do.....	3.53 p. m.	8½	.....do........
H. 5179	Carquinez Lt., N. 28½° W.... Lft. Tang. Crockett Whf., S. 80½° E. Rt. Tang. Selby Whf., S. 69° W.	5533	...do.....	4.16 p. m.	11	S............
	Lower section of bay.					
H. 5180	Ferry Bldg., N. 77° W....... Goat Id. Lt., N. 11° E. Rt. Tang. Mission Rk., S. 38° W.	5531	Oct. 8	9.55 a. m.	13	M............
	.....do........	5531	...do.....	11.15 a. m.	....	....
H. 5181	Goat Id. Lt., N. 15° W...... Ferry Bldg., N. 54° W. Rt. Tang. Mission Rk., N. 80° W.	5531	...do.....	12.01 p. m.	11	M............
H. 5182	Goat Id. Lt., N. 22° W...... Shag Rk., S. 63° W. San Bruno Lt., S. 21½° W.	5531	...do.....	12.45 p. m.	8½	.....do........
H. 5183	Shag Rk., N. 55° W......... San Bruno Lt., S. 17° W. Candlestick Pt., N. 78° W.	5531	...do.....	1.19 p. m.	7	.....do........
H. 5184	Shag Rk., N. 40½° W........ San Bruno Lt., S. 40½° W. No. 2 Beacon, S. 28° E.	5531	...do.....	1.52 p. m.	5	.....do........
H. 5185	San Bruno Lt., S. 67° W..... No. 2 Beacon, S. 29° E. Shag Rk., N. 35° W.	5531	...do.....	2.18 p. m.	4¾	.....do........
H. 5186	No. 2 Beacon, S. 32° E....... San Bruno Lt., N. 88° W. Shag Rk., N. 28½° W.	5531	...do.....	2.42 p. m.	5	.....do........

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
....	......	......	....	....	seine..........	botm...	90	....	6.0	3 hauls. Trip made with Paladini Fish Co.
....	......	......	....	....	4′ inter.; #12, #20.	surf....	20	Against tide.	.....	
....	......	......	....	....	seine..........	botm...	90	....	6.0	Do.
....	......	......	....	....	4′ inter.; #12, #20.	surf....	20	Against tide.	.....	
....	......	......	....	....	.....do..........	...do....	20	...do......	.....	
....	......	......	....	....	seine..........	botm...	90	....	6.0	Do.
66	59.97	59.68	....	....	Tnr. cse.; 4′ inter.; #12, #20; Ek. bot.; Pr. m.	surf. and botm.	....	Against tide.	.....	Flood, 1.78 knots per hr.
63	61.88	59.68	27.19	32.45	.....do..........	...do....	....	...do......	.....	Flood, 0.72 knot per hr.
64	61.38	59.68	30.20	31.09	.....do..........	...do....	11	...do......	.....	Ebb, 0.50 knot per hr. Cable out 8–10 fms.
68	60.68	59.83	27.15	30.01	.....do..........	...do....	14	...do......	.....	Ebb, 1.26 knots per hr. Cable out 4–8 fms.
67	61.98	60.83	26.23	28.40	.....do..........	...do....	12	...do......	.....	Ebb, 1.59 knots per hr. Cable out 5 fms.
65.5	62.48	61.53	21.24	26.99	.....do..........	...do....	10	...do......	.....	Ebb, 2.03 knots per hr. #20 came up muddy.
65	62.38	61.78	20.51	23.32	.....do..........	...do....	11	...do......	.....	Ebb, 2.98 knots per hr.
66.5	62.78	62.53	18.02	18.34	.....do..........	...do....	12	...do......	.....	Ebb, 1.79 knots per hr. Cable out 6 fms.
68	62.78	61.78	20.78	21.21	.....do..........	...do....	11½	...do......	.....	Ebb, 2.63 knots per hr.
56.5	57.48	57.13	32.67	32.53	Tnr. cse.; 4′ inter.; #12, #20; Ek. bot.; Pr. m.	surf. and botm.	....	....	.....	Flood, 1.50 knots per hour. Rubber packing from top of Ek. bot. lost; water sample not purely bot. water.
60	57.68	57.33	32.21	32.60	....	....	13	Against tide.	.....	Ebb, 0.41 knot per hr.
56.5	59.88	57.68	31.89	32.45	Tnr. cse.; 4′ inter., #12, #20; Ek. bot.; Pr. m.	surf. and botm.	12	...do......	.....	Ebb, 1.18 knots per hr.
57.5	59.88	59.78	31.36	31.66	.....do..........	...do....	12	...do......	.....	Ebb, 1.45 knots per hr.
59	61.88	60.83	31.27	31.36	.....do..........	...do....	12	...do......	.....	Ebb, 1.92 knots per hr.
58.5	63.08	63.03	31.29	31.27	.....do..........	...do....	12	...do......	.....	Ebb, 1.88 knots per hr.
58	63.38	62.93	31.60	31.36	.....do..........	...do....	12	...do......	.....	Ebb, 1.89 knots per hr.
57	62.88	62.73	31.27	31.33	.....do..........	...do....	11½	...do......	.....	Ebb, 1.88 knots per hr.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.	*C. S.*	1912.		*Fms.*	
H. 5187	No. 2 Beacon, S. 33° E. San Bruno Lt., N. 66° W. San Mateo Pt., S. 19° W.	5531	Oct. 8	3.15 p. m.	6½	M.
	Middle section of bay.					
H. 5188	Angel Id. Lt., N. 7° E. Alcatraz Lt., S. 43° E. Lime Pt. Lt., S. 54° W.	5532	Oct. 9	10.19 a. m.	12	hrd. S.
	do.	5532	do.	11.04 a. m.	12	
	do.	5532	do.	12.31 p. m.	12	hrd. S.
H. 5189	Southampton Lt., N. 7° E. Alcatraz Lt., S. 32° W. Blunt Pt., N. 68° W.	5532	do.	1.13 p. m.	16½	m. S.
H. 5190	Southampton Lt., N. 15½° E. Rt. Tang. Angel Id., N. 59° W. Lft. Tang. Angel Id., S. 45° W.	5532	do.	1.45 p. m.	15	do.
H. 5191	Southampton Lt., N. 65° E. Rt. Tang. Angel Id., S. 72° W. Lft. Tang. Angel Id., S. 7½° W.	5532	do.	2.14 p. m.	7½	do.
H. 5192	Bluff Pt., S. 54° W. Southampton Lt., S. 70½° E. Rt. Tang. Red Rk., N. 7° W.	5532	do.	2.41 p. m.	9	M.
H. 5193	Southampton Lt., S. 71° E. Bluff Pt., S. 12° E. Lft. Tang. Red Rk., N. 2° E.	5532	do.	3.05 p. m.	10	do.
H. 5194	Bluff Pt., S. 16° E. Lft. Tang. Red Rk., N. 42° E. Southampton Lt., S. 50½° E.	5532	do.	3.47 p. m.	7	do.
H. 5195	Brothers Lt., N. 13° E. Lft. Tang. Red Rk., S. 72° E. Southampton Lt., S. 34° E.	5532	do.	4.16 p. m.	7	do.
	Upper section of bay.					
H. 5196	Carquinez Lt., N. 33° W. Lft. Tang. Crockett Whf., S. 75½° E. Rt. Tang. Selby Whf., S. 57° W.	5533	Oct. 10	8.54 a. m.	10	M.
	do.	5533	do.	9.22 a. m.		
H. 5197	Mare Id. Lt., N. 56½° W. Carquinez Lt., N. 31° E. Tang. Crockett Whf., S. 67½° E.	5533	do.	9.50 a. m.	8	M.
H. 5198	Lone Tree Whf., S. 43° E. Mare Id. Lt., N. 57° E. Pinole Pt., S. 54° W.	5533	do.	10.31 a. m.	7	do.
H. 5199	Lone Tree Whf., S. 83° E. Pinole Pt., S. 37° W. Mare Id. Lt., N. 65½° E.	5533	do.	11.08 a. m.	5	do.
H. 5200	Brothers Lt., S. 30° W. Rt. Tang. Sisters, S. 52° W. Pinole Pt., S. 68½° E.	5533	do.	11.56 a. m.	7	do.
H. 5201	Brothers Lt., S. 29° W. Rt. Tang. Sisters, S. 65° W. Pinole Pt., N. 74° E.	5533	do.	12.20 p. m.	6½	do.
H. 5202	Brothers Lt., S. 4° W. Lft. Tang. Sisters, N. 44½° W. Lft. Tang. Marin Ids., S. 60° W.	5533	do.	12.53 p. m.	12	hrd. M.

FRANCISCO BAY, CALIF., 1912-13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
57	62.68	61.88	31.44	31.36	Tnr. cse.; 4′ inter., #12, #20; Ek. bot.; Pr. m.	surf. and botm.	12	Against tide.	.....	Ebb, 2.30 knots per hr. As grit gauze lining ripped, outer bag was used as 4′ inter. townet (1-inch mesh) at this station.
64	56.38	56.03	31.36	32.92	Tnr. cse.; 4′ inter., #12, #20; Ek. bot.; Pr. m.	surf. and botm.	......	....	.....	Flood, 1.70 knots per hr.
61	55.78	55.38	33.22	33.22	.....do.........	...do....	......	....	.....	Flood, 1.31 knots per hr.
58	55.78	54.93	33.22	33.27	.....do.........	...do....	13	Against tide.	.....	Ebb, 0.225 knot per hr. #20 bag filled with sand. Towed 5 min. under way.
58	56.48	55.83	32.67	33.18	.....do.........	...do....	20	...do......	.....	Ebb, 0.94 knot per hr. Towed 5 min. under way.
60	57.88	56.68	32.80	32.60	.....do.........	...do....	18½	...do......	.....	Ebb, 0.99 knot per hr.
66	57.88	56.98	32.83	32.60	.....do.........	...do....	15	...do......	.....	Ebb, 1.31 knots per hr.
64	58.68	57.08	32.28	32.67	.....do.........	...do....	9	...do......	.....	Ebb, 1.53 knots per hr.
71	58.88	57.78	31.90	32.27	.....do.........	...do....	11½	...do......	.....	Ebb, 0.96 knot per hr.
71	60.18	59.53	30.24	30.43	.....do.........	...do....	12	...do......	.....	Ebb, 2.92 knots per hr.
69.5	60.18	59.83	30.11	......	.....do.........	...do....	11	...do......	.....	Ebb, 2.63 knots per hr.
59	61.38	60.98	14.84	18.51	Tnr. cse.; 4′ inter., #12, #20; Ek. bot.; Pr. m.	surf. and botm.	......	....	.....	Ebb, 0.46 knot per hr.
59	61.18	61.03	14.03	17.08	.....do.........	...do....	10	Against tide.	.....	Flood, 0.50 knot per hr.
71	61.08	60.83	15.85	19.66	.....do.........	...do....	10½	...do......	.....	Flood, 1.55 knots per hr.
70	61.08	60.83	20.56	21.78	.....do.........	...do....	10	...do......	.....	Flood, 1.86 knots per hr.
70	60.88	60.83	24.77	25.16	.....do.........	...do....	12	...do......	.....	Flood, 1.18 knots per hr.
68	60.38	59.83	28.26	28.95	.....do.........	...do....	10	...do......	.....	Flood, 1.52 knots per hr.
67	59.68	59.23	29.18	30.11	.....do.........	...do....	10	...do......	.....	Flood, 1.13 knots per hr.
67	59.98	58.53	29.43	31.05	.....do.........	...do....	9½	...do......	.....	Flood, 0.45 knot per hr.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay.					
H. 5203	Goat Id. Lt., N. 21° E. Ferry Bldg., N. 66° W. Rt. Tang. Mission Rk., S. 33° W.	*C. S.* 5531	1912. Oct. 11	7.50 a. m.	*Fms.* 11	M.
H. 5204	Goat Id. Lt., N. 13° W. Ferry Bldg., N. 48° W. Rt. Tang. Mission Rk., N. 73° W.	5531	...do.....	8.19 a. m.	10¼	s. M.
H. 5205	Goat Id. Lt., N. 17½° W. Shag Rk., S. 64½° W. San Bruno Lt., S. 19½° W.	5531	...do.....	8.49 a. m.	7	M.
H. 5206	Shag Rk., N. 45° W. San Bruno Lt., S. 25° W. Candlestick Pt., N. 66½° W.	5531	...do.....	9.18 a. m.	5¾	.....do.....
H. 5207	Shag Rk., N. 32° W. San Bruno Lt., S. 40½° W. No. 2 Beacon, S. 31° E.	5531	...do.....	9.42 a. m.	5	.....do.....
H. 5208	Shag Rk., N. 29° W. No. 2 Beacon, S. 31° E. San Bruno Lt., S. 72° W.	5531	...do.....	10.04 a. m.	5	.....do.....
H. 5209	Shag Rk., N. 26° W. No. 2 Beacon, S. 35° E. San Bruno Lt., N. 82° W.	5531	...do.....	10.27 a. m.	5¾	.....do.....
H. 5210	No. 2 Beacon, S. 36° E. San Bruno Lt., N. 62° W. San Mateo Pt., S. 19° W.	5531	...do.....	10.54 a. m.	6¾	.....do.....
	Middle section of bay.					
H. 5211	Brothers Lt., N. 15° W. Lft. Tang. Red Rk., S. 73° E. Southampton Lt., S. 35° E.	5532	Oct. 12	8.27 a. m. 9.20 a. m.	7	M.
H. 5212	Bluff Pt., S. 17° E. Lft. Tang. Red Rk., N. 40° E. Southampton Lt., S. 52° E.	5532	...do.....	9.42 a. m.	7	.....do.....
H. 5213	Southampton Lt., S. 58° E. Bluff Pt., S. 10° W. Rt. Tang. Red Rk., N. 6° W.	5532	...do.....	10.06 a. m.	10	.....do.....
H. 5214	Rt. Tang. Red Rk., N. 7° W. Southampton Lt., S. 66° E. Bluff Pt., S. 45½° E.	5532	...do.....	10.38 a. m.	8	.....do.....
H. 5215	Lft. Tang. Angel Id., S. 6½° W. Southampton Lt., N. 70° E. Rt. Tang. Red Rk., N. 14° W.	5532	...do.....	11.04 a. m.	9	m. S.
H. 5216	Southampton Lt., N. 10° E. Rt. Tang. Angel Id., N. 63° W. Lft. Tang. Angel Id., N. 51° E.	5532	...do.....	11.26 a. m.	16	.....do.....
H. 5217	Southampton Lt., N. 10° E. Blunt Pt., N. 65° W. Alcatraz Lt., S. 28° W.	5532	...do.....	11.49 a. m.	22½	.....do.....
H. 5218	Angel Id. Lt., N. 12° E. Alcatraz Lt., S. 57½° E. Lime Pt. Lt., S. 57° W.	5532	...do.....	12.22 p. m.	14½	hrd. S.
	Outside Golden Gate.					
D. 5785 H. 5219	Pt. Montara Lt., N. 74½° E., 8.9 miles.	5500	Oct. 15	....	39 40	dk. gn. S.
D. 5786	Pt. Montara Lt., N. 80½° E., 9.1 miles.	5500	...do.....	....	40 40	.....do.....
D. 5787 H. 5220	Pt. Montara Lt., N. 97½° E., 8.25 miles.	5500	...do.....	....	40 41	.....do.....
	Middle section of bay.					
....	Between Angel Id. and Sausalito.	....	Oct. 19	9.40 a. m.	....	....

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	*°F.*	*°F.*					*Min.*		*Mi.*	
59	60.18	59.83	31.44	31.51	Tnr. cse.; 4' inter., #12, #20; Ek. bot., Pr. m.	surf. and botm.	10	Against tide.	.....	Flood, 1.46 knots per hr. In sta. of this date ship went with tide owing to foggy weather.
61	60.88	60.68	31.51	31.51	.....do.........	...do....	10	...do......	.....	Flood, 1.92 knots per hr.
62	61.88	61.78	31.36	31.36	.....do.........	...do....	......	...do......	.....	Flood, 1.95 knots per hr.
65	61.78	61.83	30.89	31.05	.....do.........	...do....	11	...do......	.....	Flood, 2.16 knots per hr.
66	62.08	61.83	31.18	30.91	.....do.........	...do....	10½	...do......	.....	Flood, 1.46 knots per hr.
67	62.08	62.03	31.00	31.21	.....do.........	...do....	10½	...do......	.....	Flood, 1.39 knots per hr.
70	62.18	62.23	30.94	31.05	.....do.........	...do....	11	...do......	.....	Flood, 1.44 knots per hr.
70	62.18	62.13	30.87	31.09	.....do.........	...do....	......	...do......	.....	Flood, 1.59 knots per hr.
59	60.18	59.53	28.25	29.50	Tnr. cse. ;4' inter., #12, #20; Ek. bot.; Pr. m.	surf. and botm.	4½	Against tide.	.....	Preliminary reading.
	60.18	58.83	28.02	30.11						Slack, 0.15 knot per hr.
59	59.88	58.28	28.68	30.06	.....do.........	...do....	10	...do......	.....	Flood, 0.68 knot per hr.
59	57.78	57.53	......	28.58	.....do.........	...do....	9	...do......	.....	Flood, 1.48 knots per hr.
60	57.98	57.48	31.53	31.66	.....do.........	...do....	10	...do......	.....	Flood, 1.46 knots per hr.
61	58.48	57.68	31.12	31.66	.....do.........	...do....	10	...do......	.....	Flood, 1.18 knots per hr.
62	67.08	56.48	32.08	32.18	.....do.........	...do....	10	...do......	.....	Flood, 1.36 knots per hr.
63	56.78	56.13	32.29	31.99	.....do.........	...do....	10	...do......	.....	Flood, 1.39 knots per hr.
64	55.68	56.13	33.06	32.53	.....do.........	...do....	10	...do......	.....	Flood, 1.25 knots per hr.
53	53.68	49.66	33.81	34.14	12' Ag.; 19" dr.; Ek. bot. Tnr. cse.; 4' inter.; #12, #20.	surf. and botm.	26	266½°......	1.5	Ebb. On fishing grounds. Cable out 120 fms. Inter. temp., 52.21; inter. sal., 34.17.
53	.....	......	......	......	12' Ag.; 19" dr.	botm...	20	266½°......	1.5	Ebb. On fishing grounds. Cable out 130 fms.
56	53.88	53.21	......	......	12' Ag.; 19" dr.; Ek. bot.; Tnr. cse., 4' inter.; #12, #20.	botm. and surf.	34½	269½°......	1.5	Flood. On fishing grounds. Inter. temp., 51.76; inter. sal., 34.08.
....	.....	......	......	......	4' inter.; #12, #20.	surf....	20	Against tide.	.....	

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Outside Golden Gate.	*C. S.*	1912.		*Fms.*	
D. 5788 H. 5221	Farallones Lt., N. 11½° E., 3.8 miles.	5500	Oct. 21	....	68 60	fne. gn. S.........
D.5789 H. 5222	Farallones Lt., N. 42½° W., 3.9 miles.	5500	...do.....	....	46 33	.....do............
D. 5790 H. 5223	Farallones Lt., N. 80½° W., 5.4 miles.	5500	Oct. 22	....	35 33	S.................
D. 5791 H. 5224	Farallones Lt., S. 87½° W., 8.8 miles.	5500	...do.....	....	36 29	....
D. 5792 H. 5225	San Francisco Lt. Ship, N. 37° E., 1 mile.	5500	...do.....	....	26 19	S.................
	Upper section of bay.					
D. 5793	Carquinez Lt., N. 24½° W.... Rt. Tang. Selby Whf., S. 48° W. Lft. Tang. Crockett Whf., S. 76° E.	5533	Oct. 28	....	10 14	bk. M., gy. bn. S..
D. 5794	N. W. corner Crockett Whf., N. 27½° W., 0.25 mi.	5533	...do.....	....	14½ 11	bn. S., gy. bk. M..
	Middle section of bay.					
D. 5795	Rt. Tang. Angel Id., S. 27° W. Lft. Tang. Angel Id., S. 78½° E. Southampton Lt., N. 75° E.	5532	Oct. 29	....	13 19	St.................
D. 5796	Rt. Tang. Angel Id., S. 33½° W. Lft. Tang. Angel Id., S. 80½° E. Bluff Pt., N. 8½° W.	5532	...do.....	....	19 13½	S., Sh.............
D. 5797	Rt. Tang. Angel Id., S. 78° W. Lft. Tang. Angel Id., S. 7° W. Southampton Lt., N. 61½° E.	5532	...do.....	....	8½ 7½	S.................
D. 5798	Rt. Tang. Angel Id., N. 41° E. Lft. Tang. Angel Id., N. 4° W. Southampton Lt., N. 81½° W.	5532	...do.....	....	8 7¼	M.................
D. 5799	Rt. Tang. Angel Id., S. 70° W. Lft. Tang. Angel Id., S. 3½° W. Southampton Lt., N. 67° E.	5532	...do.....	....	8½ 12½	fne. gy. m. S......
D. 5800	Alcatraz Lt., S. 66° E........ Angel Id. Lt., N. 14° E. Lime Pt. Lt., S. 66½° W.	5532	...do.....	....	16½ 16½	crs. S., St.........
D. 5801	Alcatraz Lt., S. 70½° E........ Angel Id. Lt., N. 32½° E. Lime Pt. Lt., S. 57½° W.	5532	...do.....	....	16½ 17	G., S., St..........
	Lower section of bay.					
D. 5802	Rt. Tang. Mission Rk., N. 82° W. Goat Id. Lt., N. 2° W. Ferry Bldg., N. 48½° W.	5531	Oct. 30	....	10 10¼	Sh., M.............
D. 5803	Rt. Tang. Mission Rk., N. 47° W. Goat Id. Lt., N. 18° W. Pt. Avisadero, S. 54½° W.	5531	...do.....	....	9½ 8	M.................
D. 5804	Shag Rk., S. 89½° W......... San Bruno Lt., S. 21½° W. Pt. Avisadero, N. 62° W.	5531	...do.....	....	7½ 6¾	sft. M.............

Francisco Bay, Calif., 1912–13, and March, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
55	52.38	48.76	34.16	33.99	12′ Ag.; 19″ dr.; 4′ inter.; Tnr. cse.; #12, #20; Ek. bot.	botm. and surf.	20	N. 56½° W.	1.0	Messenger on inter. therm. failed to release till brought to surf. Botm. sample and readings approximate. Inter. temp., 49.71; inter. sal., 33.99. Ebb.
55	52.58	48.86	34.16	34.31	do.	do.	20	N. 69° W.	1.0	Inter. sal., 33.83; inter. temp., 52.31. Ebb.
55	52.68	......	33.89	......	do.	do.	20	S. 61° E.	1.0	Ebb. Botm. therm. did not trip. Inter. temp. 49.51; inter. sal., 33.92.
54	52.38	49.56	33.87	34.27	do.	do.	20	do.	1.0	Ebb. Lost sounding lead after lifting from water. Inter. temp., 49.31; inter. sal., 34.01.
53	51.88	......	34.08	......	do.	do.	20	do.	1.0	Botm. Ek. bot. failed to trip. Ebb. Inter. temp., 51.81; inter. sal., 34.03.
....	....	......	......	......	oys. dr.	botm.	6	S. 81° E.	.45	Flood. Towed astern.
....	....	......	......	......	do.	do.	11	S. 87° E.	.7	Do.
53	56.00	......	......	......	oys. dr.	botm.	13	N. 31° E.	.5	Do.
55	56.00	......	......	......	do.	do.	9	N. 31° E.	.55	Flood.
56	58.00	......	......	......	5′ sldg.	do.	7½	N. 34° W.	.58	Do.
58	57.00	......	......	......	5′ sldg.; m. b.	do.	20	N. 27½° W.	1.3	Do.
59	57.00	......	......	......	do.	do.	20	N. 36½° E.	.8	Do.
59	.....	......	......	......	oys. dr.	do.	5½	S. 25° W.	.45	Ebb. Dr. caught several times registering over 5 tons.
....	....	......	......	......	do.	do.	4	S. 35° W.	.5	Ebb. Accumulator registered 5 tons.
....	....	......	......	......	5′ sldg.; m. b.	botm.	2	S. 84½° E.	.4	Flood. Towed astern. Bridle lashed to frame 1′ on each side.
....	....	......	......	......	do.	do.	12	S. 47° E.	.65	Flood. Towed astern.
....	....	......	......	......	5′ sldg.	do.	20	S. 54° E.	1.2	Do.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.	*C. S.*	1912.		*Fms.*	
D. 5805	Shag Rk., N. 56½° W. San Bruno Lt., S. 35° W. Candlestick Pt., N. 71° W.	5531	Oct. 30		5¼ 5	sft. M.
	Outside Golden Gate.					
D. 5806 H. 5226	San Francisco Lt. Ship, S. 75½° W., 2.5 miles.	5500	Nov. 4		14¼ 13	S.
D. 5807 H. 5227	Mile Rk. Lt., N. 79° E., 3.6 miles.	5500	...do.		8½ 9	
	Middle section of bay.					
D. 5808 H. 5228	Bonita Pt. Lt., N. 82° W. Fort Pt. Lt., S. 86° E. Lime Pt. Lt., N. 44° E.	5532	Nov. 4		43 27	S., G., St.
D. 5809	Bonita Pt. Lt., N. 88° W. Fort Pt. Lt., S. 76½° E. Lime Pt. Lt., N. 50½° E.	5532	...do.		53 21½	.....do.
	Off Pt. Reyes		Nov. 6		28 30	S.
	Lower section of bay.					
D.5810A H5229A	San Bruno Lt., N. 44½° W. No. 2 Beacon, S. 87° E. San Mateo Pt., N. 84° W.	5531	Nov. 11		1¾	Sh., M.
D 5810B H5229B	No. 2 Beacon, S. 87° E. San Mateo Pt., N. 84° W. San Bruno Lt., N. 44½° W.	5531	...do.		1¼	
D.5810C H.5229C	.....do.	5531	...do.		1¼	
H. 5230	No. 2 Beacon, S. 87° E. San Mateo Pt., N. 84° W. San Bruno Lt., N. 44½° W.	5531	...do.		1¼	M.
D.5811A H.5231A	San Mateo Pt., N. 63° W. San Bruno Lt., N. 33½° W. No. 2 Beacon, East.	5531	...do.		1	Sh., M.
D.5811B H.5231B	San Mateo Pt., N. 52° W. San Bruno Lt., N. 32° W. No. 2 Beacon, N. 87½° W.	5531	...do.		1	.....do.
D.5811C H.5331C	San Mateo Pt., N. 53° W. San Bruno Lt., N. 31° W. No. 2 Beacon, S. 89° E.	5531	...do.		½	Sh., M., S.
H. 5232	San Mateo Pt., N. 86½° W. San Bruno Lt., N. 33° W. No. 2 Beacon, S. 85° E.	5531	...do.		1¼	M.
	Middle section of bay.					
H. 5233	Brothers Lt., N. 17½° E. Lft. Tang. Red Rk., S. 67° E. Southampton Lt., S. 33° E.	5532	Nov. 25	8.02 a. m.	7	M.
H. 5234	Bluff Pt., S. 32° E. Lft. Tang. Red Rk., N. 49° E. Southampton Lt., S. 49° E.	5532	...do.	8.34 a. m.	7	.....do.
H. 5235	Bluff Pt., S. 18½° W. Rt. Tang. Red Rk., N. ½° E. Southampton Lt., S. 54½° E.	5532	...do.	9.03 a. m.	7½	.....do.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
59	59.00	......	......	......	5′ sldg.	botm.	20	S. 58° E.	0.46	Flood. Towed astern.
56	53.88	51.91	33.09	34.03	12′ Ag.; m. b.; Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20.	botm. and surf.	20	S. 28½° W.	1.0	Ebb. Vertical townet haul. Inter. temp., 53.51: inter. sal., 33.35.
62	54.08	53.36	32.81	32.93	do	do	21	S. 69¾° W.	1.3	Ebb. Vertical townet haul.
....	......	......	......	......	oys. dr.; 4′ inter.; #12, #20.	botm. and surf.	9	S. 44° W.	.95	Ebb. Vertical townet haul.
....	......	......	......	......	do	botm.	15	S. 54° W.	1.15	Do.
....	......	......	......	......	seine	do	90	......	6.0	2 hauls. Trip made with Paladini Fish Co.
....	57.83	56.93	31.40	31.21	oyster tongs; Ek. bot.; Tnr. cse.	botm. and surf.	......	Anchored.	......	On oyster beds, Eaton beds, southern beds. Operations conducted from scow.
....	57.13	56.18	31.42	31.36	do	do	......	do	......	Do.
....	57.33	56.53	31.40	......	do	do	......	do	......	Do.
....	......	......	......	......	Ek. bot.; Tnr. cse.; #12, #20. 4′ inter.	surf. and botm.	10	Circle	......	Ebb. Towed around Eaton oyster bed. Operations conducted from launch.
....	57.53	57.18	31.51	31.44	oyster tongs; Ek. bot.; Tnr. cse.	botm. and surf.	......	Anchored.	......	Ebb. On Moraghan bed; N. E. fence. Operations conducted from scow.
....	57.63	57.93	31.51	31.60	do	do	......	do	......	Ebb. On Moraghan bed; S. fence. Operations conducted from scow.
....	57.83	57.93	31.50	......	do	do	......	do	......	Ebb. On Moraghan bed; W. fence. Operations conducted from scow.
....	......	......	......	......	Ek. bot.; Tnr. cse.; #12, #20; 4′ inter.	surf. and botm.	10	S. 57° E.	.33	Ebb. Down NE. fence of Moraghan bed. Operations conducted from launch.
52	54.03	54.43	27.26	28.60	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	21	Against tide.	......	Flood, 0.19 knot per hr. Towed 8 min. under way. Townet #20 was fouled on inter. and did not function.
52	53.83	54.33	26.66	29.82	do	do	16	do	......	Flood, 0.79 knot per hr. Towed 5 min. under way. Townet #20 badly torn.
53	53.93	53.98	29.10	31.07	Ek. bot.; Tnr. cse.; 4′ inter.; #12; Pr. m.	do	11	do	......	Flood, 1.07 knots per hr. Lost the water-sample dipper.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1912.		*Fms.*	
H. 5236	Bluff Pt., S. 40½° W. Rt. Tang. Red Rk., N. 7° W. Southampton Lt., S. 62° E.	5532	Nov. 25	9.22 a. m.	7½	M
H. 5237	Southampton Lt., N. 60° E. Rt. Tang. Red Rk., N. 17° W. Lft. Tang. Angel Id., S. 14° W.	5532	...do.....	9.46 a. m.	8½	m. S
H. 5238	Southampton Lt., N. 19° E. Rt. Tang. Angel Id., N. 67° W. Lft. Tang. Angel Id., S. 35° W.	5532	...do.....	10.06 a. m.	14	.....do
H. 5239	Southampton Lt., N. 5° E. Blunt Pt., N. 81° W. Alcatraz Lt., S. 30° W.	5532	...do.....	10.28 a. m.	21	.....do
H. 5240	Angel Id. Lt., N. 11° E. Alcatraz Lt., S. 56° E. Lime Pt. Lt., S. 62° W.	5532	...do.....	11.04 a. m.	11½	.....do
	Upper section of bay.					
H. 5241	Carquinez Lt., N. 26½ W. Lft. Tang. Crockett Whf., S. 73° E. Rt. Tang. Selby Whf., S. 39° W.	5533	Nov. 26	10.37 a. m.	9¾	S
H. 5242	Mare Id. Lt., N. 50° W. Carquinez Lt., N. 23° E. Lft. Tang. Crockett Whf., S. 71° E.	5533	...do.....	11.07 a. m.	8½	M
H. 5243	Lone Tree Pt., S. 40° E. Mare Id. Lt., N. 65° E. Pinole Pt., S. 49½ W.	5533	...do.....	11.46 a. m.	6	.....do
H. 5244	Lone Tree Pt., S. 83° E. Pinole Pt., S. 38° W. Mare Id. Lt., N. 64° E.	5533	...do.....	12.19 p. m.	5	.....do
H. 5245	Brothers Lt., S. 28½° W. Pinole Pt., S. 75° E. Rt. Tang. Sisters, S. 51½° W.	5533	...do.....	1.04 p. m.	6½	.....do
H. 5246	Brothers Lt., S. 27½° W. Rt. Tang. Sisters, S. 61° W. Pinole Pt., N. 74½° E.	5533	...do.....	1.26 p. m.	7	.....do
H. 5247	Brothers Lt., S. 4° E. Lft. Tang. Sisters, N. 34½° W. Lft. Tang. Marin Ids., S. 57½° W.	5533	...do.....	1.58 p. m.	12½	hrd. M
	Lower section of bay.					
H. 5248	No. 2 Beacon, S. 31° E. San Bruno Lt., N. 69° W. San Mateo Pt., S. 17° W.	5531	Nov. 27	10.29 a. m.	6¼	M
H. 5249	Shag Rk., N. 28° W. No. 2 Beacon, S. 33° E. San Bruno Lt., S. 85° W.	5531	...do.....	11.05 a. m.	5	.....do
H. 5250	Shag Rk., N. 39° W. No. 2 Beacon, S. 33° E. San Bruno Lt., S. 59° W.	5531	...do.....	11.26 a. m.	6	.....do
H. 5251	Shag Rk., N. 33° W. No. 2 Beacon, S. 30° E. San Bruno Lt., S. 31° W.	5531	...do.....	11.51 a. m.	6	.....do
H. 5252	Shag Rk., N. 55° W. San Bruno Lt., S. 23° W. Candlestick Pt., N. 72° W.	5531	...do.....	12.18 p. m.	6¾	.....do
H. 5253	Goat Id. Lt., N. 17° W. Shag Rk., S. 60° W. San Bruno Lt., S. 18° W.	5531	...do.....	12.51 p. m.	9¾	.....do
H. 5254	Goat Id. Lt., N. 15° W. Ferry Bldg., N. 50° W. Rt. Tang. Mission Rk., N. 70° W.	5531	...do.....	1.23 p. m.	10½	.....do
H. 5255	Goat Id. Lt., N. 20° E. Ferry Bldg., N. 56° W. Rt. Tang. Mission Rk., S. 33° W.	5531	...do.....	1.58 p. m.	12¾	.....do

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
54	53.73	53.98	28.60	....	Ek. bot.; Tnr. cse.; 4′ inter.; #12.	surf. and botm.	11	Against tide.	.....	Flood, 1.36 knots per hr.
58	54.03	53.98	28.68	30.98	.....do.........	...do....	12	...do......	.....	Flood, 0.87 knot per hr. Ek. bot. not opened before lowering.
55	54.03	53.93	30.15	31.51	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	...do....	10	...do......	.....	Flood, 0.92 knot per hr.
55	53.83	53.88	31.99	31.82	.....do.........	...do....	11	...do......	.....	Flood, 1.17 knots per hr.
56	53.73	53.58	32.14	32.28	.....do.........	...do....	10	...do......	.....	Flood, 2.39 knots per hr.
51	53.23	53.98	14.29	20.38	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	6½	Against tide.	.....	Flood, 0.69 knot per hr. Inter. towed while under way.
56	53.53	53.73	14.62	21.35	.....do.........	...do....	10	...do......	.....	Flood, 1.27 knots per hr.
56	54.63	54.18	17.40	22.92	.....do.........	...do....	9½	With tide.	.....	Flood, 1.54 knots per hr.
54	54.33	54.38	22.83	25.62	.....do.........	...do....	10	Against tide.	.....	Flood, 1.31 knots per hr.
58	54.33	54.18	26.49	28.42	.....do.........	...do....	10	...do......	.....	Flood, 0.75 knot per hr.
58	54.73	54.08	25.85	28.26	.....do.........	...do....	10	...do......	.....	Slack, 0.44 knot per hr.
57	54.03	53.98	26.87	30.20	.....do.........	...do....	15	With tide.	.....	Ebb, 1.31 knots per hr. Net towed for 5 min. with tide.
69	55.53	55.18	29.60	30.11	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	10	Against tide.	.....	Flood, 0.67 knot per hr.
69.5	55.43	55.28	29.50	29.16	.....do.........	...do....	9	...do......	.....	Flood, 0.87 knot per hr.
69	55.23	55.18	28.28	29.16	.....do.........	...do....	14	...do......	.....	Flood, 0.86 knot per hr. Net towed 4 min.
68	55.03	54.98	28.77	28.40	.....do.........	...do....	10½	...do......	.....	Flood, 0.657 knot per hr.
70	54.53	54.43	28.72	29.16	.....do.........	...do....	17	...do......	.....	Flood, 0.87 knot per hr. Net towed 7 min.
68	54.53	54.08	29.56	30.11	.....do.........	...do....	13	...do......	.....	Flood, 0.79 knot per hr. Net towed 3 min.
65	54.53	53.93	29.43	30.43	.....do.........	...do....	14	...do......	.....	Flood (nearly slack), 0.26 knot per hr. Net towed 4 min.
63	54.63	53.88	30.35	30.82	.....do.........	...do....	13	With tide.	.....	Beginning of ebb, 0.56 knot per hr. Net towed 3 min.

Dredging and Hydrographic Records Secured in San

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.	*C. S.*	1912.		*Fms.*	
D.5812A H.5256A	No. 7 Beacon, S. 73° E., 0.7 mile.	5531	Nov. 27	10.59 a. m.	1	Sh., M.
D.5812B H.5256B	No. 7 Beacon, N. 63° E., 0.85 mile.	5531	...do.....	11.20 a. m.	1	M.
H.5257	No. 7 Beacon, N. 63° E., 0.79 mile.	5531	...do.....	11.33 a. m.	1	.....do.
D.5813 H.5258	No. 7 Beacon, S. 2½° W., 0.46 mile.	5531	...do.....	12.48 p. m.	1½	.....do.
H.5259	No. 7 Beacon, S. 2° E., 0.5 mile.	5531	...do.....	1.02 p. m.	1½	.....do.
D.5814A H.5260A	No. 4 Beacon, N. 55° E., 0.98 mile.	5531	...do.....	2.47 p. m.	1½	M., Sh.
D.5814B H.5260B	No. 4 Beacon, N. 55° E., 0.81 mile.	5531	...do.....	3.02 p. m.	1	M.
H.5261	No. 4 Beacon, N. 51½° E., 0.81 mile.	5531	...do.....	3.16 p. m.	1	.....do.
	Upper section of bay.					
H.5262	Brothers Lt., S. 9½° E. Lft. Tang. Sisters, N. 29° W. Lft. Tang. Marin Ids., S. 56° W.	5533	Dec. 3	10.16 a. m.	12	hrd. M.
H.5263	Brothers Lt., S. 23° W. Rt. Tang. Sisters, S. 64½° W. Pinole Pt., N. 72½° E.	5533	...do.....	10.49 a. m.	7	M.
H.5264	Brothers Lt., S. 30° W. Pinole Pt., S. 77° E. Rt. Tang. Sisters, S. 53½° W.	5533	...do.....	11.18 a. m.	7	.....do.
H.5265	Lone Tree Pt., S. 84½° E. Pinole Pt., S. 36° W. Mare Id. Lt., N. 64° E.	5533	...do.....	12.05 p. m.	5½	.....do.
H.5266	Lone Tree Pt., S. 37° E. Mare Id. Lt., N. 62½° E. Pinole Pt., S. 50½° W.	5533	...do.....	12.44 p. m.	5½	.....do.
H.5267	Mare Id. Lt., N. 42° W. Carquinez Lt., N. 69½° E. Lft. Tang. Crockett Whf., S. 70° E.	5533	...do.....	1.25 p. m.	8½	.....do.
H.5268	Carquinez Lt., N. 34½° W. Lft. Tang. Crockett Whf., S. 72° E. Rt. Tang. Selby Whf., S. 48° W.	5533	...do.....	1.48 p. m.	12½	S.
	Lower section of bay.					
H.5269	Goat Id. Lt., N. 15° E. Ferry Bldg., N. 73° W. Rt. Tang. Mission Rk., S. 35½° W.	5531	Dec. 4	9.59 a. m.	10	s. M.
H.5270	Goat Id. Lt., N. 16½° W. Ferry Bldg., N. 52½° W. Rt. Tang. Mission Rk., N. 76½° W.	5531	...do.....	10.40 a. m.	9½	.....do.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
68	54.23	54.41	30.89	31.27	oyster tongs; Ek.bot.; Tnr. cse.	botm. and surf.	....	Anchored.	.....	Flood. Dumbarton No. 2 oyster bed, near camp. Operations conducted from launch.
68	54.23	54.31	31.36	31.27	.....do.........	...do....	....	...do......	.....	Dumbarton No. 2 at some distance. Operations conducted from launch.
68.5	.....	......	....	....	4′ inter.; #12, #20.	surf. and botm.	10	....	.....	Flood. Townet haul between A and B. Operations conducted from launch.
67	54.93	54.76	31.05	31.18	oyster tongs; Ek.bot.; Tnr. cse.	botm. and surf.	....	Anchored.	.....	Flood. Mowry oyster bed. Operations conducted from launch.
67	55.73	......	....	....	4′ inter.; Ek. bot.; Tnr. cse.; #12, #20.	surf. and botm.	10	....	.....	Flood. Townet haul in Mowry oyster bed. Operations conducted from launch.
61	55.23	55.31	30.11	30.11	oyster tongs; Ek. bot.; Tnr. cse.	botm. and surf.	....	Anchored.	.....	Ebb. South Belmont oyster bed. Operations conducted from launch.
60	55.13	55.26	30.74	30.74	.....do.........	...do....	....	...do......	.....	Ebb. South Belmont oyster bed; another point. Operations conducted from launch.
60	.....	......	....	....	4′ inter.; #12, #20.	surf. and botm.	10	....	.....	Ebb. Townet haul in South Belmont oyster bed. Operations conducted from launch.
51	52.73	53.03	26.71	28.95	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	11	Against tide.	.....	Ebb, 1.80 knots per hr.
51	52.73	52.98	25.97	28.02	.....do.........	...do....	10	...do......	.....	Ebb, 1.23 knots per hr.
51	52.73	52.98	24.03	26.32	.....do.........	...do....	11	...do......	.....	Ebb, 1.31 knots per hr.
68	52.73	52.98	17.33	24.52	.....do.........	...do....	9½	...do......	.....	Ebb, 1.50 knots per hr.
69	52.63	52.83	17.47	22.13	.....do.........	...do....	8½	...do......	.....	Ebb, 1.74 knots per hr.
70	51.73	52.23	13.75	14.29	.....do.........	...do....	11	...do......	.....	Ebb, 1.88 knots per hr.
69	52.33	52.23	13.37	17.40	.....do.........	...do....	10	...do......	.....	Ebb, 2.89 knots per hr.
51	52.83	51.98	29.04	31.12	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	13	Against tide.	.....	Ebb, 1.39 knots per hr.
51	52.93	52.98	29.50	28.88	.....do.........	...do....	12	...do......	.....	Ebb, 2.05 knots per hr.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.	*C. S.*	1912.		*Fms.*	
H. 5271	Goat Id. Lt., N. 14½° W..... Shag Rk., S. 60° W. San Bruno Lt., S. 17° W.	5531	Dec. 4	11.19 a. m.	8	M................
H. 5272	Shag Rk., N. 51° W.......... San Bruno Lt., S. 17° W. Candlestick Pt., N. 76½° W.	5531	...do.....	11.48 a. m.	7½	.....do............
H. 5273	Shag Rk., N. 34° W.......... San Bruno Lt., S. 39½° W. No. 2 Beacon, S. 29° E.	5531	...do.....	12.20 p. m.	5	.....do............
H. 5274	Shag Rk., N. 26½° W......... San Bruno Lt., S. 70° W. No. 2 Beacon, S. 34° E.	5531	...do.....	12.48 p. m.	5	.....do............
H. 5275	Shag Rk., N. 26½° W......... San Bruno Lt., N. 86° W. No. 2 Beacon, S. 35° E.	5531	...do.....	1.11 p. m.	5	.....do............
H. 5276	No. 2 Beacon, S. 34° E........ San Bruno Lt., N. 67° W. San Mateo Pt., S. 10½° W.	5531	...do.....	1.38 p. m.	7	.....do............
	Middle section of bay.					
H. 5277	Angel Id. Lt., N. 11½° E..... Alcatraz Lt., S. 53½° E. Lime Pt. Lt., S. 60° W.	5532	Dec. 5	9.49 a. m.	14½	hrd. S............
H. 5278	Southampton Lt., N. 9° E... Blunt Pt., N. 44° W. Alcatraz Lt., S. 31° W.	5532	...do.....	10.25 a. m.	19¾	m. S..............
H. 5279	Southampton Lt., N. 17½° E.. Rt. Tang. Angel Id., N. 57° W. Lft. Tang. Angel Id., S. 41½° W.	5532	...do.....	10.56 a. m.	16	.....do............
H. 5280	Southampton Lt., N. 63½° E.. Rt. Tang. Red Rk., N. 11° W. Lft. Tang. Angel Id., S. 1° W.	5532	...do.....	11.23 a. m.	8½	.....do............
H. 5281	Southampton Lt., S. 74° E... Bluff Pt., S. 44½° W. Rt. Tang. Red Rk., N. 1½° W.	5532	...do.....	11.52 a. m.	8	M................
H. 5282	Southampton Lt., S. 60½° E.. Bluff Pt., S. 9½° W. Rt. Tang. Red Rk., N. 6° E.	5532	...do.....	12.11 p m.	9½	.....do............
H. 5283	Southampton Lt., S. 52° E... Bluff Pt., S. 19° E. Lft. Tang. Red Rk., N. 48° E.	5532	...do.....	12.41 p. m.	7	.....do............
H. 5284	Brothers Lt., N. 16° E....... Southampton Lt., S. 33½° E. Lft. Tang. Red Rk., S. 63° E.	5532	...do.....	1.12 p. m.	9	.....do............
	Upper section of bay.					
D. 5815A	Lft. Tang. Crockett Whf., S. 77° E. Carquinez Lt., N. 4° E. Rt. Tang. Selby Whf., S. 20° W.	5533	Dec. 9	11.23 a. m.	7	s. M., M..........
....	A to B.......................	5533	...do.....	11.33 a. m.	....	....
D. 5815B	Lft. Tang. Crockett Whf., S. 72° E. Carquinez Lt., N. 49° W. Rt. Tang. Selby Whf., S. 59½° W.	5533	...do.....	12.09 p. m.	13	m. S., Sh..........
D. 5816A	Carquinez Lt., N. 63° E..... Oleum Pt., S. 32° E. Mare Id. Lt., N. 33° E.	5533	...do.....	1.00 p. m.	9½	M., Sh............
....	A to B.....................	5533	...do.....	1.08 p. m.	....	....

Francisco Bay, Calif., 1912–13, and March, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
51	53.23	53.18	29.50	28.56	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf and botm.	11	Against tide.	.....	Ebb, 2.04 knots per hr.
52	53.33	53.23	29.50	29.50	.....do.........	...do....	11	...do......	.....	Ebb, 1.95 knots per hr.
52	53.73	53.78	29.95	29.95	.....do.........	...do....	10	...do......	.....	Ebb, 1.66 knots per hr.
52	53.63	53.73	30.50	29.89	.....do.........	...do....	11	...do......	.....	Ebb, 1.74 knots per hr.
53	54.53	52.93	30.20	30.28	.....do.........	...do....	10½	...do......	.....	Ebb, 1.88 knots per hr. Ek. bot. fouled, failed to trip, lowered immediately, tripped, and readings taken.
53	53.53	53.68	30.43	30.43	.....do.........	...do....	11	...do......	.....	Ebb, 1.59 knots per hr.
53	51.93	52.08	32.28	32.37	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20 Pr. m.	surf. and botm.	10	Against tide.	.....	Ebb, 0.517 knot per hr.
54	52.23	52.28	32.28	32.37	.....do.........	...do....	9½	...do......	.....	Ebb, 0.764 knot per hr.
58	52.43	52.38	31.75	32.14	.....do.........	...do....	17	...do......	.....	Ebb, 0.8 knot per hr.
58	52.53	52.38	31.66	31.66	.....do.........	...do....	15	...do......	.....	Ebb, 0.82 knot per hr.
61	52.53	52.63	29.34	31.51	.....do.........	...do....	10	...do......	.....	Ebb, 1.48 knots per hr.
62	52.63	52.68	30.66	31.21	.....do.........	...do....	11½	...do......	.....	Ebb, 2.04 knots per hr.
66	52.53	52.63	28.40	30.35	.....do.........	...do....	10½	...do......	.....	Ebb, 2.33 knots per hr.
66	52.03	52.48	27.33	29.04	.....do.........	...do....	10	...do	.....	Ebb, 2.71 knots per hr.
50	52.00	......	....	....	o. p. dr........	botm...	....	....	.....	O. p. dr. used at each end, sledge trawl through intervening distance, 0.56 mi. Flood. M. 4 inches over top of o. p. dr.
....	.....	......	....	....	5′ sldg.........	...do....	15	95°........	0.54	No M. Cable out 30 fms.
....	.....	......	....	....	o. p. dr.; 5′ sldg	...do....	....	....	.....	O. p. dr. ⅔ full; rest washed out.
52	52.00	......	....	....	.....do.........	...do....	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 0.88 mi. Flood. M. 6 inches over top.
....	.....	......	....	....	5′ sldg.........	...do....	15	76°........	0.88	No M. Cable out 30 fms.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Upper section of bay—Contd.	*C. S.*	1912.		*Fms.*	
D. 5816B	Carquinez Lt., N. 31° E. Mare Id. Lt., N. 28° W. Lft. Tang. Crockett Whf., S. 78° E.	5533	Dec. 9	1.32 p. m.	10½	M., Mi.
D. 5817A	Lone Tree Pt., S. 72° E. Mare Id. Lt., N. 61½° E. Pt. Pinole, S. 51½° W.	5533	do	2.06 p. m.	5½	s. M.
	A to B	5533	do	2.11 p. m.		
D. 5817B	Selby Wharf, S. 36° E. Mare Id. Lt., N. 59° E. Pt. Pinole, S. 54° W.	5533	do	2.43 p. m.	5½	M., S.
	Off Pt. Reyes		do		28 30	S.
	Upper section of bay.					
D. 5818A	Pt. Pinole, S. 10° E. Mare Id. Lt., N. 67° E. Lone Tree Pt., N. 89½° E.	5533	Dec. 10	10.37 a. m.	5½	M.
	A to B	5533	do	10.50 a. m.		
D. 5818B	Pt. Pinole, S. 20½° W. Mare Id. Lt., N. 69½° E. Lone Tree Pt., S. 83° E.	5533	do	11.12 a. m.	4¾	s. M., Sh.
D. 5819A	Pt. Pinole, N. 81½° E. Brothers Lt., S. 16° W. Rt. Tang. Sisters, S. 47° W.	5533	do	11.57 a. m.	7	do.
	A to B	5533	do	12.52 p. m.		
D. 5819B	Pt. Pinole, S. 69½° E. Brothers Lt., S. 23½° W. Rt. Tang. Sisters, S. 45½° W.	5533	do	1.17 p. m.	6	s. M., Sh.
D. 5820A	Brothers Lt., S. 5° E. Rt. Tang. Sisters, N. 30° W. Lft. Tang. Marin Ids., S. 60° W.	5533	do	1.51 p. m.	12½	do.
	A to B	5533	do	1.57 p. m.		
D. 5820B	Brothers Lt., S. 15° W. Rt. Tang. Sisters, S. 69½° W. Lft. Tang. Marin Ids., S. 48° W.	5533	do	2.21 p. m.	8	S., M.
	Middle section of bay.					
D. 5821A	Rt. Tang. Red Rk., N. 43° W. Brothers Lt., N. 17° E. Southampton Lt., S. 62½° E.	5532	Dec. 17	12.45 p. m.	8	S., M., Sh.
	A to B	5532	do	1.15 p. m.		
D. 5821B	Rt. Tang. Red Rk., N. 14° E. Brothers Lt., N. 5° E. Southampton Lt., S. 71° E.	5532	do	1.38 p. m.	9¾	S., M., Sh.
D. 5822A	Brothers Lt., N. 57½° E. Southampton Lt., S. 38½° E. Rt. Tang. Red Rk., S. 56° E.	5532	do	2.05 p. m.	5	do.
	A to B	5532	do	2.09 p. m.		

FRANCISCO BAY, CALIF., 1912-13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	F.					Min.		Mi.	
....	....	....	....	....	o. p. dr	botm	....	....	....	O. p. dr. 8 inches over full.
53	53.00	....	....	....	o. p. dr.; 5' sldg.	do	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.16 mi. Ebb. More than filled.
....	....	....	....	....	5' sldg	do	23	64°	1.16	Flood. Cable out 20 fms. Large tub M. landed.
....	....	....	....	....	o. p. dr	do	....	....	....	M. 1 foot above top.
....	....	....	....	....	seine	do	90	....	6.00	Trips made with Paladini Fish Co.
51	50.50	....	....	....	o. p. dr	botm	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.16 mi. M. 6 inches above edge.
....	....	....	....	....	5' sldg	do	15½	58°	1.16	Slack. Cable out 20 fms. No M. except on trawl runners.
....	....	....	....	....	o. p. dr	do	....	....	....	O. p. dr. 6 inches over full.
52	50.00	....	....	....	o. p. dr.; 5' sldg.	do	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.25 mi.; 6 inches over full.
....	....	....	....	....	5' sldg	do	16½	42°	1.25	Flood. Clean haul. Cable out 25 fms.
....	....	....	....	....	o. p. dr	do	....	....	....	Full.
53	52.00	....	....	....	do	do	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.1 mi.; 6 inches over full.
....	....	....	....	....	5' sldg	do	17	30½°	1.1	Clean haul. Flood. Cable out 40 fms.
....	....	....	....	....	o. p. dr	do	....	....	....	
54	53.00	....	....	....	o. p. dr	botm	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 1 mi. Off California City. Level full.
....	....	....	....	....	5' sldg	do	12	134°	1.0	Ebb. No M. taken.
....	....	....	....	....	o. p. dr	do	....	....	....	
55	53.00	....	....	....	do	do	....	....	....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.17 mi.; 6 inches over full.
....	....	....	....	....	5' sldg	do	14	182°	1.17	Ebb. Cable out 25 fms.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1912.		*Fms.*	
D. 5822B	Brothers Lt., N. 36½° E. Rt. Tang. Red Rk., S. 88° E. Southampton Lt., S. 48° E.	5532	Dec. 17	2.28 p. m.	6	M.
D. 5823A	Brothers Lt., N. 35° E. Rt. Tang. Red Rk., N. 85° E. Southampton Lt., S. 51° E.	5532	...do.....	3.14 p. m.	7	M., Sh.
....	A to B.	5532	...do.....	3.19 p. m.	....	....
D. 5823B	Brothers Lt., N. 23½° E. Rt. Tang. Red Rk., N. 59° E. Southampton Lt., S. 58° E.	5532	...do.....	3.52 p. m.	10½	M., Sh.
D. 5824A	Rt. Tang. Red Rk., S. 44° E. Brothers Lt., N. 48° E. Lft. Tang. Marin Id., N. 41° W.	5532	Dec. 18	10.02 a. m.	12½	gy. M.
....	A to B.	5532	...do.....	10.07 a. m.	....	....
D. 5824B	Rt. Tang. Red Rk., S. 68½° E. Brothers Lt., N. 13° E. Lft. Tang. Marin Id., N. 36° W.	5532	...do.....	10.29 a. m.	7	Sh., S.
D. 5825A	Rt. Tang. Angel Id., S. 60½° W. Southampton Lt., N. 79½° E. Lft. Tang. Angel Id., S. 6° W.	5532	...do.....	10.56 a. m.	8½	S.
....	A to B.	5532	...do.....	11.01 a. m.	....	....
D. 5825B	Rt. Tang. Angel Id., N. 75° W. Southampton Lt., N. 7° E. Lft. Tang. Angel Id., S. 43½° W.	5532	...do.....	11.35 a. m.	12½	S.
D. 5826A	Rt. Tang. Red Rk. N. 20° E. Southampton Lt., S. 45½° E. Bluff Pt., S. 1° E.	5532	...do....	12.44 p. m.	7	S., Sh.
....	A to B.	5532	...do.....	12.55 p. m.	....	....
D. 5826B	Rt. Tang. Red Rk., N. 8° W. Southampton Lt., S. 52° E. Bluff Pt., S. 38° W.	5532	...do.....	1.16 p. m.	9	S., Sh.
	Upper section of bay.		1913.			
H. 5285	Brothers Lt., S. 9½° E. Lft. Tang. Sisters, N. 27° W. Lft. Tang. Marin Ids., S. 59° W.	5533	Jan. 13	9.53 a. m.	12½	M.
H. 5286	Brothers Lt., S. 23° W. Rt. Tang. Sisters, S. 67½° W. Pinole Pt., N. 71½° E.	5533	...do.....	10.28 a. m.	7	.....do.
H. 5287	Brothers Lt., S. 31° W. Pinole Pt., S. 75° E. Rt. Tang. Sisters, S. 54° W.	5533	...do.....	11.01 a. m.	6½	.....do.
H. 5288	Lone Tree Pt., S. 83° E. Pinole Pt., S. 35° W. Mare Id. Lt., N. 65° E.	5533	...do.....	11.44 a. m.	5	.....do.
H. 5289	Lone Tree Pt., S. 31° E. Pinole Pt., S. 50½° W. Mare Id. Lt., N. 64° E.	5533	...do.....	12.39 p. m.	5¾	S.
H. 5290	Mare Id. Lt., N. 33° W. Carquinez Lt., N. 68° E. Lft. Tang. Crockett Whf., S. 72° E.	5533	...do.....	1.14 p. m.	9½	M.

FRANCISCO BAY, CALIF., 1912-13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
					o. p. dr	botm				Rather more than level full.
54	53.00				do	do				O. p. dr. used at each end, sledge trawl through intervening distance, 0.8 mi. Level full.
					5′ sldg	do	19	163°	0.8	Slack. Cable out 30 fms.; ½ full M.
					o. p. dr	do				Much more than full.
63	53.00				do	do				O. p. dr. used at each end, sledge trawl through intervening distance, 1.16 mi.; 6-8 inches above edge.
					5′ sldg	do	14½	150°	1.16	Ebb. Cable out 40 fms.
					o. p. dr	do				Level full.
63	53.00				do	do				O. p. dr. used at each end, sledge trawl through intervening distance, 1.1 mi. Level full.
					5′ sldg	do	15	143°	1.1	Ebb. Cable out 30 fms. Landed wrong side up. Full M.
					o. p. dr	do				
57	53.00				do	do				O. p. dr. used at each end, sledge trawl through intervening distance, 1.2 mi.; 2/3 full.
					5′ sldg	do	15	142°	1.2	Ebb. Cable out 25 fms.
					o. p. dr	do				Level full.
48	41.83	45.43	24.39	25.31	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Alb. smp.	surf. and botm.	19	Against tide.		Net towed 3 min. Ebb.
50	44.83	44.93	23.68	24.30	do	do	10	do		Ebb.
50	44.73	44.83	22.68	22.90	do	do	10	do		Net towed 3½ min. Ebb.
51	43.73	44.18	18.56	22.83	do	do	29½	do		Net towed 3 min. Ebb.
51	43.23	43.93	14.45	20.12	do	do	16	do		Net towed 3½ min. Ebb.
53	42.73	42.98	14.00	15.92	do	do	16	do		Ebb. Net towed 3 min.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Upper section of bay—Con.	*C. S.*	1913.		*Fms.*	
H. 5291	Carquinez Lt., N. 43° W. Lft. Tang. Crockett Whf., S. 69° E. Rt. Tang. Selby Whf., S. 42° W.	5533	Jan. 13	1.38 p. m.	12	m. S.
H. 5292	Carquinez Lt., N. 43° W. Lft. Tang. Crockett Whf., S. 69° E. Rt. Tang. Selby Whf., S. 45° W.	5533	...do...	1.48 p. m.	12	...do...
H. 5293	Lone Tree Pt., S. 28° E. Pinole Pt., S. 52° W. Mare Id. Lt., N. 61° E.	5533	...do...	2.31 p. m.	5	S.
H. 5294	Lone Tree Pt., S. 82½° E. Pinole Pt., S. 37½° W. Mare Id. Lt., N. 66½° E.	5533	...do...	3.06 p. m.	4¾	M.
H. 5295	Brothers Lt., S. 31½° W. Pinole Pt., S. 70° E. Rt. Tang. Sisters, S. 53½° W.	5533	...do...	3.54 p. m.	7	...do...
H. 5296	Brothers Lt., S. 25° W. Rt. Tang. Sisters, S. 65° W. Pinole Pt., N. 70½° E.	5533	...do...	4.28 p. m.	7	...do...
	Middle section of bay.					
D. 5827A	Lime Pt. Lt., N. 81½° W. Alcatraz Lt., N. 80½° E. Angel Id. Lt., N. 11½° E.	5532	Jan. 20	9.19 a. m.	17	S., Sh., G.
....	A to B.	5532	...do...	9.33 a. m.	....	....
D. 5827B	Lime Pt. Lt., N. 89° W. Alcatraz Lt., N. 76½° E. Angel Id. Lt., N. 18° W.	5532	...do...	9.52 a. m.	6¾	S., G.
D. 5828A	Southampton Lt., N. 3° E. Alcatraz Lt., S. 32½° W. Lft. Tang. Angel Id., N. 87° W.	5532	...do...	10.18 a. m.	16½	M., S.
....	A to B.	5532	...do...	10.27 a. m.	....	....
D. 5828B	Southampton Lt., N. 28° E. Rt. Tang. Angel Id., N. 76° W. Lft. Tang. Angel Id., S. 25½° W.	5532	...do...	10.47 a. m.	10¼	M., S., Sh.
D. 5829A	Angel Id. Lt., N. 18° E. Alcatraz Lt., S. 48½° E. Lime Pt. Lt., S. 53° W.	5532	...do...	11.40 a. m.	10½	S., fne. G., Sh.
....	A to B.	5532	...do...	11.46 a. m.	....	....
D. 5829B	Angel Id. Lt., N. 38° E. Alcatraz Lt., S. 78½° E. Lime Pt. Lt., S. 53° W.	5532	...do...	12.09 p. m.	15½	S., fne., G., Sh.
H. 5297	Angel Id. Lt., N. 7° E. Alcatraz Lt., S. 51° E. Lime Pt. Lt., S. 60½° W.	5532	...do...	12.51 p. m.	10	m. S.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
53	42.73	43.43	12.28	17.20	Ek. bot.; Tnr. cse., 4′ inter.; #12, #20; Alb. smp.	surf. and botm.	10	Against tide.	.....	Ebb.
53	42.73	43.43	12.67	17.40	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20.	...do....	15	...do......	.....	Flood. Net towed 5 min.
52	43.23	43.93	15.23	20.43	.....do.........	...do....	13½	...do......	.....	Flood. Net towed 3 min.
52	43.83	44.78	18.41	22.74	.....do.........	...do....	16	...do......	.....	Do.
51	44.93	45.58	24.13	26.62	.....do.........	...do....	14	...do......	.....	Flood. Net towed 4 min.
51	45.53	45.93	27.72	24.39	.....do.........	...do....	10	...do......	.....	Flood. Net towed 2 min.
48	49.00	......	......	......	o. p. dr........	botm...	......	....	.....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.06 mi. Flood. Cable out 40 fms.
....	.....	......	......	......	5′ sldg.........	...do....	14	81°........	1.06	"A" includes two dips with o. p. dr. Neither gave full load. Net of trawl almost completely ripped from frame. Contents caught in folds saved. At "B" o. p. dr. more than full.
48	49.00	......	......	......	o. p. dr........	...do....	......	....	.....	More than level full.
48	49.00	......	......	......	.....do.........	...do....	......	....	.....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.07 mi. Ebb. O. p. dr. more than full.
....	.....	......	......	......	5′ sldg.........	...do....	27	340°.......	1.07	Cable out 30 fms.
48	49.00	......	......	......	o. p. dr........	...do....	......	....	.....	O. p. dr. 8–10 ins. over full.
52	50.00	......	......	......	.....do.........	...do....	......	....	.....	O. p. dr. used at each end, sledge trawl through intervening distance, 1.06 mi. Ebb. O. p. dr., 3 dips; last, ⅔ full, only lot sifted.
....	.....	......	......	......	5′ sldg.........	...do....	10	232½°......	1.06	Cable out 30 fms. Coaster meager haul.
52	50.00	......	......	......	o. p. dr........	...do....	......	....	.....	O. p. dr. practically empty, nothing saved.
59	47.73	47.93	28.97	29.82	Alb. smp.; Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20.	surf. and botm.	5	Against tide.	.....	Ebb.

Dredging and Hydrographic Records Secured in San

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1913.		*Fms.*	
H. 5298	Southampton Lt., N. 10½° E. Alcatraz Lt., S. 30½° W. Blunt Pt., N. 51° W.	5532	Jan. 20	1.38 p. m.	20½	m. S.
H. 5299	Southampton Lt., N. 18° E. Rt. Tang. Angel Id., N. 61½° W. Lft. Tang. Angel Id., S. 41° W.	5532	...do.....	2.26 p. m.	15½	.....do.
H. 5300	Southampton Lt., S. 57° E. Rt. Tang. Red Rk., N. 15½° W. Lft. Tang. Angel Id., S. 16° W.	5532	...do.....	2.56 p. m.	7	.....do.
H. 5301	Southampton Lt., S. 71° E. Bluff Pt., S. 49½° W. Rt. Tang. Red Rk., N. 4° W.	5532	...do.....	3.27 p. m.	10	M.
H. 5302	Southampton Lt., S. 61° E. Bluff Pt., S. 11½° W. Rt. Tang. Red Rk., N. 5½° E.	5532	...do.....	4.03 p. m.	10	.....do.
H. 5303	Southampton Lt., S. 49° E. Bluff Pt., S. 13½° E. Lft. Tang. Red Rk., N. 44° E.	5532	...do.....	4.33 p. m.	7	m. S.
H. 5304	Brothers Lt., N. 18° E. Southampton Lt., S. 36° E. Lft. Tang. Red Rk., S. 70° E.	5532	...do.....	5.03 p. m.	7	M.
D. 5830A	Alcatraz Lt., S. 76½° W. Southampton Lt., N. 4° W. Rt. Tang. Goat Id., S. 41½° E.	5532	Jan. 21	9.40 a. m.	11	S.
....	A to B	5532	...do.....	9.46 a. m.	....	....
D. 5830B	Alcatraz Lt., W. Southampton Lt., N. 14° W. Rt. Tang. Goat Id., S. 27° E.	5532	...do.....	10.00 a. m.	8½	S., M.
	Lower section of bay.					
D. 5831	Ferry Bldg., N. 88° E. Goat Id. Lt., N. 43½° E. Rt. Tang. Mission Rk., S. 15° W	5532	Jan. 21	10.22 a. m.	13	M., S., Sh.
H. 5305	Goat Id. Lt., N. 20° E. Ferry Bldg., N. 72° W. Rt. Tang. Mission Rk., S. 31½° W.	5531	...do.....	11.34 a. m.	12½	S., M.
H. 5306	Goat Id. Lt., N. 16½° W. Ferry Bldg., N. 53° W. Rt. Tang. Mission Rk., N. 79° W.	5531	...do.....	12.17 p. m.	8	M.
H. 5307	Goat Id. Lt., N. 13° W. Shag Rk., S. 60½° W. San Bruno Lt., S. 16° W.	5531	...do.....	1.01 p. m.	9	.....do.
H. 5308	Shag Rk., N. 55° W. San Bruno Lt., S. 17° W. Candlestick Pt., N. 78° W.	5531	...do.....	1.32 p. m.	7½	.....do.
H. 5309	Shag Rk., N. 38° W. San Bruno Lt., S. 43° W. No. 2 Beacon, S. 27½° E.	5531	...do.....	2.09 p. m.	4¾	.....do.
H. 5310	Shag Rk., N. 34° W. San Bruno Lt., S. 64° W. No. 2 Beacon, S. 29° E.	5531	...do.....	2.32 p. m.	4¾	.....do.
H. 5311	Shag Rk., N. 31° W. San Bruno Lt., W. No. 2 Beacon, S. 30½° E.	5531	...do.....	2.55 p. m.	5	.....do.

FRANCISCO BAY, CALIF., 1912-13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
62	47.63	48.18	29.06	30.74	Alb. smp.; Ek. bot.; Tnr. cse. 4′ inter.; #12, #20.	surf. and botm.	22½	Against tide.	.....	Ebb.
59	47.63	47.78	28.56	29.50	.....do.........	...do....	9	...do.......	.....	Do.
56	47.23	47.63	25.31	28.72	.....do.........	...do....	9	...do.......	.....	Do.
58	47.03	47.18	26.78	26.32	.....do.........	...do....	10	...do.......	.....	Do.
55	46.73	47.08	24.30	25.31	.....do.........	...do....	7	...do.......	.....	Do.
52	46.23	46.88	17.40	22.99	.....do.........	...do....	9	...do.......	.....	Ebb. Tide slacked suddenly for a few minutes; 4′ inter. touched botm.
50	46.13	46.68	17.86	22.83	.....do.........	...do....	7½	...do.......	.....	Ebb. O. p. dr. used at each end, sledge trawl through intervening distance, 0.65 mi.
47	50.00	......	......	......	o. p. dr........	botm...	......	....	.....	O. p. dr., two dips aggregated 1 bucket full. Flood.
....	.....	......	......	......	5′ sldg.........	...do....	10	117°.......	0.65	
....	.....	......	......	......	o. p. dr........	...do....	......	....	.....	Flood. O. p. dr. 10–12 ins. more than full. Undoubtedly one of the richest spots in the bay in respect to total number of living organisms.
48	50.00	......	......	......	o. p. dr........	botm...	......	Single spot.	.....	Flood. O. p. dr. much more than full. One of series of three in Berkeley ferry track. Very little life, in marked contrast to last station.
48	47.23	48.18	28.02	30.59	Alb. smp.; Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20.	surf. and botm.	12	Against tide.	.....	Ebb.
44	47.73	47.78	28.02	29.50	.....do.........	...do....	10	...do.......	.....	Do.
45	46.83	47.08	27.87	27.87	.....do.........	...do....	11	...do.......	.....	Do.
47	46.63	46.68	27.79	27.94	.....do.........	...do....	10	...do.......	.....	Do.
48	45.83	45.93	28.26	28.49	.....do.........	...do....	10	...do.......	.....	Do.
49	45.83	45.93	28.40	28.56	.....do.........	...do....	10½	...do.......	.....	Do.
51	45.73	45.93	28.84	29.08	.....do.........	...do....	10	...do.......	.....	Do.

Dredging and Hydrographic Records Secured in San

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay—Con.					
H. 5312	No. 2 Beacon, S. 32½° E. San Bruno Lt., N. 69° W. San Mateo Pt., S. 13° W.	*C. S.* 5531	1913. Jan. 21	3.20 p. m.	*Fms.* 5	M.
D. 5832	Goat Id. Lt., N. 19½° W. Ferry Bldg., S. 81° W. Rt. Tang. Mission Rk., S. 30° W.	5531	Jan. 27		9¼	S., M.
H. 5313	No. 2 Beacon, S. 39° E. San Bruno Lt., N. 62° W. San Mateo Pt., S. 10° W.	5531	...do...	12.17 p. m.	5¼	M.
H. 5314	Shag Rk., N. 32° W. San Bruno Lt., W. No. 2 Beacon, S. 29½° E.	5531	...do...	12.48 p. m.	5½	...do...
H. 5315	Shag Rk., N. 35° W. San Bruno Lt., S. 66° W. No. 2 Beacon, S. 28½° E.	5531	...do...	1.11 p. m.	5¼	...do...
H. 5316	Shag Rk., N. 39° W. San Bruno Lt., S. 45½° W. No. 2 Beacon, S. 27° E.	5531	...do...	1.33 p. m.	5	...do...
H. 5317	Shag Rk., N. 50½° W. San Bruno Lt., S. 18½° W. Candlestick Pt., N. 74° W.	5531	...do...	2.02 p. m.	6	...do...
H. 5318	Goat Id. Lt., N. 18° W. Shag Rk., S. 62° W. San Bruno Lt., S. 19° W.	5531	...do...	2.33 p. m.	7	...do...
H. 5319	Goat Id. Lt., N. 18° W. Ferry Bldg., N. 53° W. Rt. Tang. Mission Rk., S. 77° W.	5531	...do...	3.08 p. m.	9¼	...do...
H. 5320	Goat Id. Lt., N. 1° E. Ferry Bldg., N. 67° W. Rt. Tang. Mission Rk., S. 35° W.	5531	...do...	3.44 p. m.	13	m. S.
D. 5833	Goat Id. Lt., N. 58° W. Ferry Bldg., S. 86½° W. Rt. Tang. Mission Rk., S. 52½° W.	5531	...do...	4.17 p. m.	6¼	S., Sh.
	Middle section of bay.					
H. 5321	Brothers Lt., N. 20° E. Southampton Lt., S. 37½° E. Lft. Tang. Red Rk., S. 78° E.	5532	Jan. 28	2.11 p. m.	8	M.
H. 5322	Southampton Lt., S. 49° E. Bluff Pt., S. 18° E. Lft. Tang. Red Rk., N. 50° E.	5532	...do...	2.38 p. m.	6¾	m. S.
H. 5323	Southampton Lt., S. 58° E. Bluff Pt., S. 11° W. Rt. Tang. Red Rk., N. 5° E.	5532	...do...	3.02 p. m.	7½	M.
H. 5324	Southampton Lt., S. 70° E. Bluff Pt., S. 40° W. Rt. Tang. Red Rk., N. 3½° W.	5532	...do...	3.24 p. m.	10	...do...
H. 5325	Southampton Lt., N. 66½° E. Rt. Tang. Angel Id., S. 69½° W. Lft. Tang. Angel Id., S. 14° W.	5532	...do...	3.46 p. m.	7	m. S.
H. 5326	Southampton Lt., S. 20° E. Rt. Tang. Angel Id., N. 69½° W. Lft. Tang. Angel Id., S. 35° W.	5532	...do...	4.08 p. m.	13	...do...
H. 5327	Southampton Lt., N. 9° E. Alcatraz Lt., S. 29½° E. Blunt Pt., N. 65° W.	5532	...do...	4.29 p. m.	19	hrd. M.
H. 5328	Angel Id. Lt., N. 6° E. Alcatraz Lt., S. 47° E. Lime Pt. Lt., S. 57½° W.	5532	...do...	5.00 p. m.	10	hrd. S.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
48	45.73	45.88	28.37	29.18	Alb. smp.; Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20.	surf. and botm.	10	Against tide.	.....	Ebb.
....	......	......	....	....	o. p. dr........	botm...	....	....	.....	Ebb. 2 dips each rather more than half full. Second of series of three in Ferry track.
53	46.53	46.68	28.56	28.84	Alb. smp.; Ek. bot.; 4′ inter.; #12, #20; Tnr. cse.; Pr. m.	surf. and botm.	18	Against tide.	.....	Flood, 0.75 knot per hr.
67	46.93	46.93	28.33	28.49	.....do.........	...do....	12	...do......	.....	Flood, 0.90 knot per hr.
68	47.03	51.08	28.02	27.94	.....do.........	...do....	11	...do......	.....	Flood, 1.03 knots per hr.
66	47.53	47.43	27.33	27.40	.....do.........	...do....	11	...do......	.....	Flood.
64	47.83	47.23	26.62	27.01	.....do.........	...do....	11	...do......	.....	Flood, 1.52 knots per hr.
65	47.93	47.18	25.55	26.94	.....do.........	...do....	11	...do......	.....	Flood, 1.70 knots per hr.
66	47.73	47.78	26.10	26.73	.....do.........	...do....	12	...do......	.....	Flood, 0.78 knot per hr.
64	48.23	48.33	26.39	28.33	.....do.........	...do....	11	...do......	.....	Flood, 0.74 knot per hr.
63	48.00	......	....	....	o. p. dr........	botm...	....	....	.....	Flood. o. p. dr. considerably more than half full. Third of series in Ferry track.
56.5	47.03	47.38	15.23	21.60	Alb. smp.; Ek. bot.; 4′ inter.; #12, #20; Tnr. cse.; Pr. m.	surf. and botm.	4	Against tide.	.....	Flood, 0.65 knot per hr. Towed 4 min.
56	46.93	47.53	14.91	23.29	.....do.........	...do....	14½	...do......	.....	Flood, 0.21 knot per hr. Towed 3 min.
55	47.93	48.28	18.02	27.10	.....do.........	...do....	13½	...do......	.....	Flood, 0.18 knot per hr. Towed 3 min.
55	47.93	48.33	25.85	27.13	.....do.........	...do....	10	...do......	.....	Flood, 0.61 knot per hr.
55	48.23	48.43	19.66	28.11	.....do.........	...do....	15	...do......	.....	Flood, 0.79 knot per hr. Towed 5 min.
55	48.13	48.88	25.70	28.55	.....do.........	...do....	10	...do......	.....	Flood, 1.52 knots per hr.
52.5	48.23	48.93	26.62	29.50	.....do.........	...do....	10	...do......	.....	Flood.
50	48.73	48.98	29.04	29.95	.....do.........	...do....	10½	...do......	.....	Flood, 1.05 knots per hr.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Lower section of bay.	*C. S.*	1913.		*Fms.*	
D. 5834	Goat Id. Lt., N. 15½° W..... Rt. Tang. Mission Rk., N. 83½° W. Ferry Bldg., N. 56° W.	5531	Feb. 3	10.06 a. m.	11	m. S., Sh........
D. 5835	Goat Id. Lt., N. 9½° W...... Shag Rk., N. 58½° W. San Bruno Lt., S. 21° W.	5531	...do....	10.38 a. m.	7½	s. M., Sh..........
D. 5836	No. 2 Beacon, S. 31½° E...... San Bruno Lt., S. 69½° W. Candlestick Pt., N. 44° W.	5531	...do.....	11.04 a. m.	6	M...............
D. 5837	No. 2 Beacon, S. 35° E....... San Bruno Lt., N. 68° W. San Mateo Pt., S. 9° W.	5531	...do.....	11.23 a. m.	6½	.....do............
D. 5838	San Bruno Pt., N. 89° W.... No. 2 Beacon, S. 32° E. Shag Rk., N. 30° W.	5531	...do.....	11.39 a. m.	5½	.....do............
D. 5839	Shag Rk., N. 36° W......... San Bruno Lt., S. 45° W. No. 2 Beacon, S. 28° E.	5531	...do.....	11.54 a. m.	5¾	M., Sh............
D. 5840	Goat Id. Lt., N. 15½° W..... Shag Rk., S. 60° W. San Bruno Lt., S. 16° W.	5531	...do.....	12.23 p. m.	9½	M.................
D. 5841	Goat Id. Lt., N. 19° E....... Rt. Tang. Mission Rk., S. 34° W. Ferry Bldg., N. 78° W.	5531	...do.....	12.48 p. m.	12	S., M., Sh.........
	Middle section of bay.					
....	Between Angel Id. and Sausalito.	....	Feb. 8	9.15 a. m.	....	....
....	.....do.....................	....	Feb. 15	8.50 a. m.	....	....
....	.....do.....................	....	Mar. 1	9.15 a. m.	....	....
....	.....do.....................	....	Mar. 8	....	....	....
....	Fort Baker Beach...........	....	Mar. 14	2.00 p. m.	0 3	S.................
....	Between Angel Id. and Sausalito.	....	Mar. 15	9.30 a. m.	....	....
....	Angel Id., Raccoon Str.......	....	Mar. 20	9.00 a. m.	0 3	M., E. G..........
....	Between Angel Id. and Sausalito.	....	Mar. 24	930 a. m.	....	....
....	Angel Id., near Blunt Pt....	....	Mar. 27	2.00 p. m.	0 3	S.................
....	Between Angel Id. and Sausalito.	....	Mar. 31	9.35 a. m.	....	....
....	Sausalito; Fisherman's Beach	....	Apr. 5	9.00 a. m.	0 3	S.................
D. 5842	Mile Rk. Lt., S. 51° W....... Bonita Pt. Lt., N. 57° W. Fort Pt. Lt., N. 59° E.	5532	Apr. 7	10.00 a. m.	25 28	Sh., St............
D. 5843	Mile Rk. Lt., S. 3½° E........ Bonita Pt. Lt., N. 43° W. Fort Pt. Lt., N. 65° E.	5532	...do.....	10.40 a. m.	25 27	.....do............
D. 5844	Mile Rk. Lt., S. 23° E........ Bonita Pt. Lt., N. 44° W. Fort Pt. Lt., N. 81½° E.	5532	...do.....	11.10 a. m.	22 31	.....do............
D. 5845	Bonita Pt. Lt., N. 74° W.... Lime Pt. Lt., N. 45° E. Fort Pt. Lt., N. 81° E.	5532	...do.....	11.39 a. m.	33 49	.....do............
D. 5846	Bonita Pt. Lt., N. 89° W.... Lime Pt. Lt., N. 45° E. Fort Pt. Lt., S. 73½° E.	5532	...do.....	12.10 p. m.	45 50	.....do............
....	Between Angel Id. and Sausalito.	....	Apr. 14	10.00 a. m.	....	....
....	Fort Baker Beach...........	....	Apr. 18	9.00 a. m.	0 3	S.................

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
47	49.00				o. p. dr	botm.		Single spot		Flood, 4 inches over level full.
47.5	49.00				do.	do.		do.		Slightly fuller than preceding. Flood.
48	49.00				do.	do.		do.		6–8 inches over level full. Flood.
51	49.00				do.	do.		do.		Flood. Over 8 inches more than level full.
52	49.50				do.	do.		do.		Flood, 12 inches over level full.
53	50.00				do.	do.		do.		Ebb, 8 inches over level full.
56.5	50.00				do.	do.		do.		Ebb, 10 inches over level full.
57	50.00				do.	do.		do.		Ebb, ¾ full.
					4′ inter.; #12, #20.	surf.	20	Against tide.		
					do.	do.	20	do.		
					do.	do.	20	do.		
					do.	do.	20	do.		
					250′ seine	do.	150			3 hauls.
					4′ inter.; #12, #20.	do.	20	Against tide.		
					250′ seine	do.	120			2 hauls.
					4′ inter.; #12, #20.	do.	20	Against tide.		
					250′ seine	do.	120			3 hauls.
					4′ inter.; #12, #20.	do.	20	Against tide.		
					250′ seine	do.	120			Do.
55					oys. dr. without lining.	botm.	6	49°	0.52	Cable out 75 fms. Flood.
56					do.	do.	4½	49°	.39	Do.
54					do.	do.	4	50°	.53	Flood. Cable out 65 fms.
					do.	do.	5	49°	.5	Flood. Cable out 125 fms.
					do.	do.	3	71°	.53	Flood. Cable out 125 fms. Chain bag torn in several places and all but 4 teeth of dr. carried away.
					4′ inter.; #12, #20.	surf.	20	Against tide.		
					250′ seine	do.	90			2 hauls.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1913.		*Fms.*	
....	Between Angel Id. and Sausalito.	....	Apr. 19	9.00 a. m.	....	....
	Lower section of bay.					
D. 5847A	Beacon No. 4, S. 80½° E. Beacon No. 3, S. 62° E. Beacon No. 1, S. 14½° W.	5531	Apr. 22	11.09 a. m.	8½	M.
....	A to B	5531	...do.....	11.19 a. m.	....	....
D. 5847B	Beacon No. 4, S. 35° W. Beacon No. 1, S. 22½° E. Beacon No. 3, S. 59° E.	5531	...do.....	11.49 a. m.	9	Sh., m. S.
D. 5848A	Beacon No. 2, N. 72½° W. Little Coyote Knoll, S. 67° W. Beacon No. 4, S. 50½° E.	5531	...do.....	12.47 p. m.	9	M.
....	A to B	5531	...do.....	12.55 p. m.	....	....
D. 5848B	Beacon No. 2, S. 75° W. Little Coyote Knoll, S. 11° W. Beacon No. 4, S. 52½° E.	5531	...do.....	1.41 p. m.	9½	M., Sh., G.
D. 5849A	Beacon No. 2, S. 26° E. Pt. San Mateo, S. 63° W. San Bruno Lt., N. 55½° W.	5531	...do.....	2.09 p. m.	10	M.
....	A to B	5531	...do.....	2.14 p. m.	....	....
D. 5849B	Beacon No. 2, S. 30° E. Pt. San Mateo, S. 37° W. San Bruno Lt., N. 60° W.	5531	...do.....	2.39 p. m.	9	M.
	Middle section of bay.					
....	Between Angel Id. and Sausalito.	....	Apr. 26	9.30 a. m.	....	....
....	Tiburon, Raccoon Strait	....	Apr. 29	2.00 p. m.	0 3	M.
....	Angel Id. near Blunt Pt	....	May 5	9.00 a. m.	0 3	S.
....	Between Angel Id. and Sausalito.	....	...do.....	1.15 p. m.	....	....
....	.....do	....	May 12	9.00 a. m.	....	....
....	Fort Baker Beach	....	May 13	2.00 p. m.	0 3	....
....	Between Angel Id. and Sausalito.	....	May 19	9.30 a. m.	....	....
....	.....do	....	May 26	1.30 p. m.	....	....
....	.....do	....	June 2	10.00 a. m.	....	....
....	.....do	....	June 9	9.30 a. m.	....	....
....	.....do	....	June 16	9.30 a. m.	....	....
....	.....do	....	June 23	9.30 a. m.	....	....
....	.....do	....	July 2	11.30 a. m.	....	....
....	.....do	....	July 7	9.30 a. m.	....	....
H. 5329	Lime Pt. Lt., S. 72° W. Alcatraz Lt., S. 78° E. Pt. Knox, N. 39° E.	5532	July 18	7.00 a. m.	28	rky. S.
	.....do	5532	...do.....	8.00 a. m.	28	.....do
	.....do	5532	...do.....	9.00 a. m.	28	.....do
	.....do	5532	...do.....	10.00 a. m.	28	.....do
	.....do	5532	...do.....	11.00 a. m.	28	.....do

Francisco Bay, Calif., 1912–13, and March, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
....	.....	.....	....	....	4' inter.; #12, #20.	surf....	20	Against tide.	.....	O. p. dr. used at each end, Alb. smp. at "A," sledge trawl through intervening distance, 0.83 mi.
....	.....	.....	....	....	o. p. dr.; Alb. smp.	botm...	......	....	.....	Flood. Rather more than level full, with surface layer washed off.
....	.....	.....	....	....	5' sldg.........	...do....	19	310°.......	0.83	Cable out 35 fms.
....	.....	.....	....	....	o. p. dr.; Alb. smp.	...do....	......	....	.....	Level full.
....	.....	.....	....	....	.....do.........	...do....	......	....	.....	O. p. dr. used at each end, Alb. smp. at "A," sledge trawl through intervening distance, 1.1 mi. More than level full. Flood.
....	.....	.....	....	....	5' sldg.........	...do....	32½	304°.......	1.1	Cable out 30 fms.
....	.....	.....	....	....	o. p. dr.; Alb. smp.	...do....	......	....	.....	
....	.....	.....	....	....	.....do.........	...do....	......	....	.....	Flood. More than level full.
....	.....	.....	....	....	5' sldg.........	...do....	17½	325°.......	.95	Cable out 30 fms.
....	.....	.....	....	....	o. p. dr.; Alb. smp.	...do....	......	....	.....	Rather more than full.
....	.....	.....	....	....	4' inter.; #12, #20.	surf....	20	Against tide.	.....	
....	.....	.....	....	....	250' seine......	....	150	....	.....	2 hauls.
....	.....	.....	....	....	.....do.........	....	120	....	.....	3 hauls.
....	.....	.....	....	....	4' inter.; #12, #20.	surf....	20	Against tide.	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	250' seine......	....	120	....	.....	Do.
....	.....	.....	....	....	4' inter.; #12, #20.	surf....	20	Against tide.	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	.....	.....	....	....	.....do.........	...do....	20	...do.......	.....	
....	60.00	58.30	29.33	30.01	Ek. bot.; Tnr. cse.; 4' inter.; #12, #20; Pr. m.	surf and botm.	......	...do.......	.....	Ship at anchor. Flood, 0.50 knot per hr. Ship headed S. by W.
....	59.40	58.55	29.38	29.97	.....do.........	...do....	......	...do.......	.....	Flood, 1.22 knots per hr. Ship headed S. 24° W.
....	58.10	61.95	30.19	30.53	.....do.........	...do....	......	...do.......	.....	Flood, 1.91 knots per hr. Ship headed S. 10° E.
....	57.10	56.70	30.90	31.27	.....do.........	...do....	......	...do.......	.....	Flood, 1.87 knots per hr.
....	57.20	56.00	30.24	31.65	.....do.........	...do....	......	...do.......	.....	Flood, 0.89 knot per hr. Ship headed S. 54° W. Ship started to swing, did swing a bit, then stopped at position noted.

Dredging and Hydrographic Records Secured in San

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1913.		*Fms.*	
H. 5329	Lime Pt. Lt.; S. 72° W Alcatraz Lt., S. 78° E. Pt. Knox, N. 39° E.	5532	July 18	12.00 noon.	28	rky. S
	do	5532	do	1.00 p. m.	28	do
	do	5532	do	2.00 p. m.	28	do
	do	5532	do	3.00 p. m.	28	do
	do	5532	do	4.00 p. m.	28	do
	do	5532	do	5.00 p. m.	28	do
	do	5532	do	6.00 p. m.	28	do
	do	5532	do	7.00 p. m.	28	do
	do	5532	do	7.30 p. m.	28	do
	Upper section of bay.					
H. 5330	Pinole Pt., N. 56° E Brothers Lt., S. Rt. Tang. Sisters, N. 28° W.	5533	July 21	10.00 a. m.	11	M
	do	5533	do	11.00 a. m.	11	do
	do	5533	do	12.00 noon.	11	do
	do	5533	do	1.00 p. m.	11	do
	do	5533	do	2.00 p. m.	11	do
	do	5533	do	3.00 p. m.	11	do
	do	5533	do	4.00 p. m.	8	do
	do	5533	do	5.00 p. m.	8	do
	do	5533	do	6.00 p. m.	8	do
	do	5533	do	7.00 p. m.	8	do
H. 5331	San Pablo Bay, off mouth of Petaluma Creek, Lt. R (6), N. 41° W., 0.59 mile.	5533	do	2.51 p. m.	1	do
H. 5332	San Pablo Bay, off mouth of Petaluma Creek, Lt. R (6), N. 41° W., 2.26 miles.	5533	do	3.32 p. m.	1½	do
H. 5333	San Pablo Bay, off mouth of Petaluma Creek, Lt. R (2), N. 71° W., 0.75 mile.	5533	do	4.07 p. m.	2	do
H. 5334	San Pablo Bay; Pt. Pinole, S. 26° E., 2.03 miles.	5533	do	4.52 p. m.	3	do

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
....	58.10	55.30	30.41	32.10	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	....	Against tide.	.....	Flood, 0.76 knot per hr. Ship headed S. 81° W.
....	57.60	55.20	30.61	32.50	do	do	....	do	.....	Flood, nearly slack, 0.50 knot per hr. Ship headed S. 81° W.
....	58.00	55.60	30.72	32.00	do	do	....	do	.....	Ebb, 0.66 knot per hr. Ship headed W.
....	58.00	55.25	30.91	32.41	do	do	....	do	.....	Ebb, 1.20 knots per hr. Ship headed N. 60° W.
....	56.90	55.50	31.58	32.05	do	do	....	do	.....	Ebb, 1.15 knots per hr. Ship headed NNW.
....	57.10	55.85	31.00	31.87	do	do	....	do	.....	Ebb, 1.01 knots per hr. Ship headed N. 10° W.
....	56.70	56.55	31.42	31.62	do	do	....	do	.....	Ebb, 0.76 knot per hr. Ship headed N. 18° W. Ship swung to tide completely at 6.30.
....	57.10	56.55	31.18	31.53	do	do	....	do	.....	Flood, 0.74 knot per hr. Ship headed S. 51° E.
....	57.10	56.60	31.13	31.49	do	do	....	do	.....	Flood, 0.66 knot per hr. Wire broke, repaired, but current meter did not register properly.
....	64.10	63.05	21.44	24.83	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	....	Against tide.	.....	Ship at anchor Flood, 0.77 knot per hr. Ship headed S. 65° W.
....	62.90	62.50	22.05	26.13	do	do	....	do	.....	Flood, 0.89 knot per hr. Ship headed S. 6° W.
....	62.80	62.05	23.03	26.47	do	do	....	do	.....	Flood, 1.56 knots per hr. Ship headed S. 3° E.
....	63.20	61.80	23.80	26.74	do	do	....	do	.....	Flood, 2.18 knots per hr. Ship headed S.
....	62.30	60.70	25.28	28.40	do	do	....	do	.....	Flood, 1.99 knots per hr. Ship headed S. 16° W.
....	61.30	60.15	26.31	28.84	do	do	....	do	.....	Flood, 1.45 knots per hr. Ship headed S. 6° W.
....	61.10	59.85	28.10	29.34	do	do	....	do	.....	Flood, 1.10 knots per hr. Ship headed S.
....	62.10	59.85	27.25	29.34	do	do	....	do	.....	Flood, 0.32 knot per hr. Ship headed S. 12° E.
....	62.10	60.00	26.94	29.25	do	do	....	do	.....	Slack, 0.16 knot per hr. Ship headed S. 72° E.
....	62.20	60.75	26.64	28.64	do	do	....	do	.....	Ebb, 1.35 knots per hr. Ship headed N. 1° E.
....	.....	68.80	18.35	18.33	Ek. bot.	botm.	....	....	.....	Flood. Launch used.
....	.....	66.25	21.02	21.02	do	do	....	....	.....	Do.
....	.....	64.10	24.07	24.14	do	do	....	....	.....	Do.
....	.....	63.20	25.46	25.53	do	do	....	....	.....	Do.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Upper section of bay—Con.	*C. S.*	1913.		*Fms.*	
H. 5335	San Pablo Bay; Pt. Pinole, S. 72° W., 0.73 mile.	5533	July 21	5.32 p. m.	1¾	M
	Middle section of bay.					
H. 5336	Fort Pt. Lt., S. 73½° W Lime Pt. Lt., N. 71° W. Angel Id. Lt., N. 9° E.	5532	July 22	7.30 a. m.	8	S
H. 5337	Southampton Lt., N. 15° W. Alcatraz Lt., N. 69° W. Lft. Tang. Goat Id., N. 83½° E.	5532	...do	8.20 a. m.	13	...do
H. 5338	Southampton Lt., N. 9° E Alcatraz Lt., S. 33° W. Blunt Pt., N. 41° W.	5532	...do	9.05 a. m.	16	...do
H. 5339	Southampton Lt., S. 68° E Bluff Pt., S. 48° W. Rt. Tang. Red Rk., N. 5° W.	5532	...do	10.00 a. m.	9¾	M
	...do	5532	...do	11.00 a. m.	12	
H. 5340	Southampton Lt., N. 8° E Alcatraz Lt., S. 33° W. Blunt Pt., N. 56° W.	5532	...do	11.45 a. m.	23¾	S
H. 5341	Southampton Lt., N. 15° W. Alcatraz Lt., N. 66° W. Lft. Tang. Goat Id., N. 55° E.	5532	...do	12.25 p. m.	8½	...do
H. 5342	Fort Pt. Lt., S. 75° W Lime Pt. Lt., N. 72° W. Angel Id. Lt., N. 7° E.	5532	...do	1.25 p. m.	11	...do
	Lower section of bay.					
H. 5343	Goat Id. Lt., N. 17° W Ferry Bldg., N. 55° W Rt. Tang. Mission Rk., N. 83° W.	5531	July 23	8.50 a. m.	10	M
H. 5344	Candlestick Pt., N. 51° W Shag Rk., N. 35° W. San Bruno Lt., S. 42° W.	5531	...do	10.00 a. m.	4½	...do
H. 5345	No. 2 Beacon, S. 33° E San Bruno Lt., N. 70° W. San Mateo Pt., S. 13° W.	5531	...do	10.40 a. m.	5¾	...do
	...do	5531	...do	11.40 a. m.		
H. 5346	Candlestick Pt., N. 53° W Shag Rk., N. 36° W. San Bruno Lt., S. 44° W.	5531	...do	1.05 p. m.	5	M
H. 5347	Goat Id. Lt., N. 19½° W Ferry Bldg., N. 55° W. Rt. Tang. Mission Rk., N. 79½° W.	5531	...do	2.14 p. m.	9½	...do
H. 5348	No. 2 Beacon, S. 31½° W., 6 miles.	5531	...do	10.54 a. m.	⅔	...do
H. 5349	No. 2 Beacon, S. 13° W., 4.33 miles.	5531	...do	11.27 a. m.	2	...do
H. 5350	No. 2 Beacon, S. 22° E., 3.3 miles.	5531	...do	12.00 noon.	3½	...do
	Middle section of bay.					
	Between Angel Id. and Sausalito.		Sept. 15	6.45 a. m.		
	...do		Sept. 24	6.45 a. m.		
	...do		Oct. 1	1.00 p. m.		
	...do		Oct. 9	9.30 a. m.		
	...do		Oct. 20	2.30 p. m.		
			1914.			
H. 5351	Angel Id. Lt., N. 18° E Alcatraz Lt., S. 54° E. Lime Pt. Lt., S. 57° W.	5532	Mar. 5	9.17 a. m.	10	S
H. 5352	Southampton Lt., N. 73° E Rt. Tang. Angel Id., S. 64° W. Lft. Tang. Angel Id., S. 18° W.	5532	...do	11.02 a. m.	7	m. S

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
....	.....	64.60	24.36	24.42	Ek. bot.......	botm...	....	....	.....	Flood. Launch used.
....	59.10	59.30	30.41	30.37	Ek. bot.; Pr. m.	botm...	....	....	.....	Ebb, 1.74 knots per hr.
....	62.90	62.05	29.02	29.23	.....do.........	...do....	....	....	.....	Ebb, 1.13 knots per hr.
....	61.00	58.70	28.26	28.77	.....do.........	...do....	....	....	.....	Ebb, 1.68 knots per hr.
....	61.80	59.55	26.73	29.74	.....do.........	...do....	....	....	.....	Ebb, 0.65 knot per hr.
....	62.10	59.15	....	30.03	.....do.........	...do....	....	....	.....	Flood, 0.37 knot per hr.
....	60.30	58.70	29.16	30.26	.....do.........	...do....	....	....	.....	Flood, 1.05 knots per hr. Bow midway in Golden Gate.
....	60.30	59.30	28.35	30.08	.....do.........	...do....	....	....	.....	Flood, 1.56 knots per hr. Ship headed N. 42° W.
....	59.10	59.90	....	31.49	.....do.........	...do....	....	....	.....	Flood, 1.97 knots per hr. Headed toward Mt. Diablo.
....	64.10	62.60	28.42	29.04	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf. and botm.	....	Against tide.	.....	Ebb, 0.95 knot per hr.
....	69.20	62.05	27.92	27.92	.....do.........	...do....	....	...do......	.....	Flood, 0.22 knot per hr. Net towed 3 min.
....	69.10	63.95	27.85	27.81	.....do.........	...do....	....	...do......	.....	Flood, 0.27 knot per hr.
....	69.20	68.95	27.83	27.83	.....do.........	...do....	....	...do......	.....	Flood, 1.05 knots per hr.
....	67.20	63.90	28.75	28.78	.....do.........	...do....	....	...do......	.....	Flood, 1.21 knots per hr.
....	62.20	60.85	28.91	29.74	.....do.........	...do....	....	Against tide.	.....	Flood, 1.35 knots per hr.
....	.....	68.75	27.61	27.56	Ek. bot........	botm...	....	....	.....	Flood. Launch used.
....	.....	69.15	27.34	27.34	.....do.........	...do....	....	....	.....	Do.
....	.....	69.10	27.77	27.79	.....do.........	...do....	....	....	.....	Do.
....	.....	......	....	....	4′ inter.; #12, #20.	surf....	20	Against tide.	.....	
....	.....	......	....	....	.....do.........	...do....	20	...do......	.....	
....	.....	......	....	....	.....do.........	...do....	20	...do......	.....	
....	.....	......	....	....	.....do.........	...do....	20	...do......	.....	
....	.....	......	....	....	.....do.........	...do....	20	...do......	.....	
63	*54.2	53.2	12.81	29.04	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; NZ; Pr. m.	...do....	8⅔	Anchored.	.....	Ebb tide. 1.83 knots per hr. NZ Surf., #98523; L, #71738; R, #98260.
59	*54.5	53.5	11.78	18.35	.....do.........	...do....	9¼	...do......	.....	Ebb tide. 2.43 knots per hr.

DREDGING AND HYDROGRAPHIC RECORDS SECURED IN SAN

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Middle section of bay—Con.	*C. S.*	1914.		*Fms.*	
H. 5353	Brothers Lt., N. 22½° E. Southampton Lt., S. 36½° E. Rt. Tang. Red Rk., S. 67° E.	5532	Mar. 5	11.45 a. m.	8½	S.
	Upper section of bay.					
H. 5354	Brothers Lt., S. 27° W. Pinole Pt., N. 69½° E. Rt. Tang. Sisters Id., S. 68° W.	5533	Mar. 5	1.11 p. m.	6½	M.
H. 5355	Pinole Pt., S. 36½° W. Lone Tree Pt., S. 79° E. Mare Id. Lt., N. 68° E.	5533	...do...	1.57 p. m.	6	...do...
H. 5356	Carquinez Lt., N. 45½° W. Lft. Tang. Crockett Whf., S. 68° E. Rt. Tang. Selbe Whf., S. 50° W.	5533	...do...	2.44 p. m.	13	m. S.
	Middle section of bay.					
H. 5357	Angel Id. Lt., N. 26° E. Alcatraz Lt., S. 54° E. Lime Pt. Lt., S. 53° W.	5532	Mar. 5	4.41 p. m.	9½	S.
H. 5358	Fort Pt. Lt., S. 64° W. Lime Pt. Lt., N. 69½° W. Angel Id. Lt., N. 18° E.	5532	Mar. 6	10.18 a. m.	17	...do...
H. 5359	Southampton Lt., N. 14° W. Alcatraz Lt., N. 71½° W. Lft. Tang. Goat Id., N. 89° E.	5532	...do...	11.04 a. m.	16½	
	Lower section of bay.					
H. 5360	Goat Id. Lt., N. 23½° E. Ferry Bldg., N. 74° W. Rt. Tang. Mission Rk., S. 25° W.	5531	Mar. 6	11.33 a. m.	12	
H. 5361	Shag Rk., N. 53½° W. San Bruno Lt., S. 17½° W. Candlestick Pt., N. 76° W.	5531	...do...	12.21 p. m.	6½	
H. 5362	No. 2 Beacon, S. 35½° E. San Bruno Lt., N. 68° W. San Mateo Pt., S. 8° E.	5531	...do...	1.29 p. m.	6	M.
H. 5363	Goat Id. Lt., N. 12° E. Ferry Bldg., N. 71½° W. Rt. Tang. Mission Rk., S. 40° W.	5531	...do...	2.52 p. m.	10½	m. S.
	Middle section of bay.					
H. 5364	Southampton Lt., N. 14° W. Lft. Tang. Goat Id., N. 77° E. Alcatraz Lt., N. 67° W.	5532	Mar. 6	3.21 p. m.	21	S., M.
H. 5365	Fort Pt. Lt., S. 72½° W. Lime Pt. Lt., N. 67° W. Angel Id. Lt., N. 13° E.	6532	...do...	3.57 p. m.	12½	S.

FRANCISCO BAY, CALIF., 1912–13, AND MARCH, 1914—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
63	*54.1	53.4	....	24.65	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; NZ; Pr. m.	surf....	9⅔	Anchored.	.....	Salinity too low to be secured from Knudsen's Tables. Ebb tide 3.40 knots per hr.
66	*53.8	53.55	7.65	11.04	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; NZ; Pr. m.	surf....	8½	Anchored.	.....	Ebb tide, 0.90 knot per hr.
72	*55.7	53.8	4.02	13.42	.....do..........	...do....	10	...do.......	.....	Ebb tide, 2.06 knots per hr.
79	*54.2	54.35	....	3.77	.....do..........	...do....	8	...do.......	.....	Salinity too low to be secured from Knudsen's Tables. Ebb tide 2.19 knots per hr.
58	*54.8	53.05	11.62	30.34	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; NZ; Pr. m.	surf....	10½	Anchored.	.....	Flood tide, 0.51 knot per hr.
59	*54.7	53.15	15.12	30.52	.....do..........	...do....	11	...do.......	.....	Ebb tide, 3.02 knots per hr.
60	*55.1	53.2	14.72	29.60	.....do..........	...do....	11½	...do.......	.....	Ebb tide, 2.79 knots per hr.
59	*55.5	53.15	12.32	30.07	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; NZ; Pr. m.	surf....	11	Anchored.	.....	Ebb tide, 1.01 knots per hr.
64	*56.1	54.15	11.85	20.32	.....do..........	...do....	31	...do.......	.....	Ebb tide, 0.95 knot per hr.
62	*56.7	53.7	12.27	23.17	.....do..........	...do....	11	...do.......	.....	Ebb tide, 1.61 knots per hr.
66	*56.3	53.25	11.46	29.23	.....do..........	...do....	13	...do.......	.....	Flood tide, 0.32 knot per hr.
66	*55.5	53.2	10.03	30.57	Ek. bot.; Tnr. cse.; 4′ inter.; #12, #20; Pr. m.	surf....	8½	Anchored.	.....	Flood tide, 2.73 knots per hr.
70	*55.8	53.25	12.45	30.05	.....do..........	...do....	9	...do.......	.....	Flood tide, 0.84 knot per hr.

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H.5366	Heceta Head Lt., N. 69½° E., 27.3 miles.	6000	Apr. 29	5.00 a. m.	68	Shl., rky
H.5367	Heceta Head Lt., N. 68° E., 28.2 miles.	6000	...do...	5.22 a. m.	79	fne. bk. S.
H.5368	Heceta Head Lt., N. 66½° E., 28.8 miles.	6000	...do...	5.33 a. m.	84	...do...
H.5369	Umpqua River Lt., S. 56½° E., 29 miles.	6000	...do...	5.47 a. m.	110	...do...
H.5370	Heceta Head Lt., N. 67° E., 30.3 miles.	6000	...do...	6.04 a. m.	80	Shl., rky
H.5371	Heceta Head Lt., N. 69° E., 31 miles.	6000	...do...	6.15 a. m.	84	Shl., gran
H.5372	Heceta Head Lt., N. 70½° E., 31.6 miles.	6000	...do...	6.35 a. m.	90	fne. G.
H.5373	Heceta Head Lt., N. 72° E., 32.3 miles.	6000	...do...	6.50 a. m.	165	fne. bk. S.
H.5374	Heceta Head Lt., N. 73½° E., 32.2 miles.	6000	...do...	7.10 a. m.	100	
H.5375	Heceta Head Lt., N. 75° E., 31.7 miles.	6000	...do...	7.30 a. m.	84	crs. G.
H.5376	Heceta Head Lt., N. 76½° E., 31.3 miles.	6000	...do...	7.50 a. m.	80	Shl., hrd. M.
H.5377	Heceta Head Lt., N. 78½° E., 31.5 miles.	6000	...do...	8.05 a. m.	88	Shl., rky. gran., bk. S., G.
H.5378	Heceta Head Lt., N. 79½° E., 31.7 miles.	6000	...do...	8.15 a. m.	92	G.
H.5379	Heceta Head Lt., N. 85° E., 32.7 miles.	6000	...do...	12.25 p. m.	182	fne. bk. S.
H.5380	Heceta Head Lt., E., 31.8 miles.	6000	...do...	1.05 p. m.	130	Shl., rky
H.5381	Heceta Head Lt., S. 85° E., 30.9 miles.	6000	...do...	1.50 p. m.	81	...do...
H.5382	Heceta Head Lt., S. 82° E., 30.6 miles.	6000	...do...	2.18 p. m.	80	
H.5383	Heceta Head Lt., S. 78½° E., 30.5 miles.	6000	...do...	3.20 p. m.	76	Shl., rky
H.5384	Heceta Head Lt., S. 76° E., 30.3 miles.	6000	...do...	3.45 p. m.	60	...do...
H.5385	Heceta Head Lt., S. 73° E., 30.3 miles.	6000	...do...	4.05 p. m.	61	M.
H.5386	Heceta Head Lt., S. 70½° E., 30.2 miles.	6000	...do...	4.32 p. m.	67	fne. bk. S., fne G.
H.5387	Heceta Head Lt., S. 69° E., 28.2 miles.	6000	...do...	5.10 p. m.	63	Shl
H.5388	Heceta Head Lt., S. 66° E., 26 miles.	6000	...do...	6.00 p. m.	55	
H.5389	Heceta Head Lt., S. 76° E., 24.5 miles.	6000	Apr. 30	1.00 p. m.	61	Shl., hrd. M.
H.5390	Heceta Head Lt., S. 76° E., 26.2 miles.	6000	...do...	1.37 p. m.	67	Shl., rky
H.5391	Heceta Head Lt., S. 75½° E., 27.1 miles.	6000	...do...	2.04 p. m.	64	bk. S., M.
H.5392	Heceta Head Lt., S. 75° E., 28.3 miles.	6000	...do...	2.24 p. m.	62	Shl., gran
H.5393	Heceta Head Lt., S. 75° E., 29.9 miles.	6000	...do...	2.46 p. m.	71	Shl., hrd. M.
H.5394	Heceta Head Lt., S. 72° E., 29.9 miles.	6000	...do...	3.22 p. m.	79	gn. M.
H.5395	Heceta Head Lt., S. 69½° E., 29.7 miles.	6000	...do...	3.49 p. m.	81	...do...
H.5396	Heceta Head Lt., S. 65° E., 29.7 miles.	6000	...do...	4.52 p. m.	82	Shl., gran
H.5397	Heceta Head Lt., S. 61° E., 30 miles.	6000	...do...	5.51 p. m.	85	gn. M.; fne. bk. S.
H.5398	Yaquina Lt., S. 89½° E., 19.6 miles.	6000	May 2	12.00 noon.	95	...do...
H.5399	Yaquina Lt., S. 87° E., 19.5 miles.	6000	...do...	12.17 p. m.	83	...do...
H.5400	Yaquina Lt., S. 83½° E., 19.1 miles.	6000	...do...	12.34 p. m.	90	...do...
H.5401	Yaquina Lt., S. 84° E., 19.9 miles.	6000	...do...	12.52 p. m.	98	...do...

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
51	47.0				Tnr.-Blish sdr.; 30-lb. lead.					
51	47.0				do					
51.5	48.0				do					
51.5	49.0				do					
52	50.0				do					
52	50.0				do					
52	50.0				do					
52	50.0				do					
52	50.0				do					Lead dropped twice. No sample.
53	50.0				do					
54	50.0				do					
54	50.0				Tnr.-Blish sdr.; 30-lb. lead; 1 skate.	botm	60			Salt herring used as bait.
54	50.0				do	do	60			Do.
54	51.5				Tnr.-Blish sdr.; 30-lb. lead.					
56	53.0				do					
57	53.0				do					
57	53.0				do					Sounding wire fouled propeller; 61 fms. cable cut away. No sample.
57	52.0				Tnr.-Blish sdr.; 28-lb. lead.					
58	51.0				do					
58	51.0				do					
58	50.5				do					
58	50.0				do					
56	50.0				do					Lead lost on haul in.
54	52.0				do					
55	52.0				do					
53.6	52.0				do					
53.5	52.0				do					
53	52.0				do					
52	52.0				do					
52	52.0				do					
54	52.0				do					
53	52.0				do					
54	52.0				Tnr.-Blish sdr.; 25-lb. lead.					
54	52.0				do					
54	52.0				do					
53.5					do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.			*Fms.*	
H. 5402	Yaquina Lt., S. 82° E., 19.8 miles.	6000	1914. May 2.	1.15 p. m.	96	gn. M.; fne. bk. S..
H. 5403	Yaquina Lt., S. 80½° E., 19.8 miles.	6000	...do.....	1.28 p. m.	96	.....do............
H. 5404	Yaquina Lt., S. 77° E., 19.5 miles.	6000	...do.....	4.49 p. m.	84	Shl., hrd. M.......
H. 5405	Yaquina Lt., S. 74° E., 19.4 miles.	6000	...do.....	5.05 p. m.	82	Shl., rky..........
H. 5406	Yaquina Lt., S. 71½° E., 19.2 miles.	6000	...do.....	5.27 p. m.	89	gn. M............
H. 5407	Yaquina Lt., S. 68½° E., 19.2 miles.	6000	...do.....	5.38 p. m.	96	.....do............
H. 5408	Yaquina Lt., S. 60° E., 19.3 miles.	6000	...do.....	6.18 p. m.	96	.....do............
H. 5409	Yaquina Lt., S. 50½° E., 19.2 miles.	6000	...do.....	6.56 p. m.	96	.....do............
H. 5410	Yaquina Lt., S. 43° E., 20.9 miles.	6000	...do.....	7.35 p. m.	93	.....do............
H. 5411	Yaquina Lt., S. 33° E., 19.6 miles.	6000	May 3	9.29 a. m.	101	.....do............
H. 5412	Yaquina Lt., S. 28° E., 20 miles.	6000	...do.....	10.07 a. m.	96	.....do............
H. 5413	Yaquina Lt., S. 21½° E., 20.3 miles.	6000	...do.....	10.45 a. m.	88	.....do............
H. 5414	Yaquina Lt., S. 15½° E., 21.5 miles.	6000	...do.....	11.20 a. m.	83	.....do............
H. 5415	Yaquina Lt., S. 15½° E., 22.2 miles.	6000	...do.....	11.40 a. m.	83	.....do............
H. 5416	Yaquina Lt., S. 15½° E., 22.8 miles.	6000	...do.....	11.57 a. m.	92	.....do............
H. 5417	Yaquina Lt., S. 13° E., 23.3 miles.	6000	...do.....	12.22 p. m.	85	.....do............
H. 5418	Yaquina Lt., S. 15½° E., 24.4 miles.	6000	...do.....	12.58 p. m.	92	.....do............
H. 5419	Yaquina Lt., S. 15° E., 26.6 miles.	6000	...do.....	1.40 p. m.	100	.....do............
H. 5420	Yaquina Lt., S. 15° E., 28.8 miles.	6000	...do.....	2.20 p. m.	112	.....do............
H. 5421	Yaquina Lt., S. 15° E., 31 miles.	6000	...do.....	3.00 p. m.	109	.....do............
H. 5422	Yaquina Lt., S. 15° E., 34 miles.	6000	...do.....	3.55 p. m.	103	.....do............
H. 5423	Cape Kiwanda, S. 77° E., 14 miles.	6000	...do.....	4.56 p. m.	99	.....do............
H. 5424	Cape Meares Lt., N. 54½° E., 17.1 miles.	6100	...do.....	5.46 p. m.	108	.....do............
H. 5425	Cape Meares Lt., N. 70° E., 17 miles.	6100	...do.....	6.28 p. m.	99	.....do............
H. 5426	Cape Meares Lt., N. 80° E., 16.6 miles.	6100	...do.....	7.07 p. m.	106	.....do............
H. 5427	Cape Meares Lt., N. 86° E., 16.4 miles.	6100	May 4	6.09 a. m.	100	.....do............
H. 5428	Cape Meares Lt., N. 86° E., 15.1 miles.	610C	...do.....	6.29 a. m.	98	.....do............
H. 5429	Cape Meares Lt., S. 84° E., 16.3 miles.	6100	...do.....	7.36 a. m.	100	.....do............
H. 5430	Cape Meares Lt., S. 76° E., 17.9 miles.	6100	...do.....	8.34 a. m.	98	Shl., hrd. M.......
H. 5431	Cape Meares Lt., S. 74° E., 18.3 miles.	6100	...do.....	8.49 a. m.	100	gn. M............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
54	51.0	......	......	......	Tnr.-Blish sdr.; 25-lb lead.	......	......	......	......	
54	51.0	......	......	......	Tnr.-Blish sdr.; 25-lb lead; o. p. dr., Alb. smp.; 2 skates.	botm...	60	......	......	Dories lowered at 1.35 p. m. O. p. dr. dropped at 2.01 p. m.; hauled in 2.07; empty. Alb. smpl. down 2.29; up 2.33; upper part slightly bent; struck by weight (520 lbs.) rigged 4 fms. above sampler. Salt herring bait.
50	53.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
50	53.0	......	......	......	......do......	......	......	......	......	
50	53.0	......	......	......	......do......	......	......	......	......	
51	53.0	......	......	......	......do......	......	......	......	......	
52	52.0	......	......	......	......do......	......	......	......	......	
52	52.0	......	......	......	......do......	......	......	......	......	
52	52.0	......	......	......	......do......	......	......	......	......	
53	51.0	......	......	......	......do......	......	......	......	......	
54	52.0	......	......	......	......do......	......	......	......	......	
55	52.0	......	......	......	......do......	......	......	......	......	
55	52.0	......	......	......	......do......	......	......	......	......	
54.5	52.0	......	......	......	......do......	......	......	......	......	
54.5	52.0	......	......	......	......do......	......	......	......	......	
55	52.0	......	......	......	......do......	......	......	......	......	
54	52.0	......	......	......	......do......	......	......	......	......	
56	52.0	......	......	......	......do......	......	......	......	......	
56	52.0	......	......	......	......do......	......	......	......	......	
56	51.0	......	......	......	......do......	......	......	......	......	
55	51.0	......	......	......	......do......	......	......	......	......	
55	51.0	......	......	......	......do......	......	......	......	......	
54	50.0	......	......	......	......do......	......	......	......	......	
52	50.0	......	......	......	......do......	......	......	......	......	
52	50.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead; Alb. smp.	......	......	......	......	
53	52.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
53	52.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead; 4′ inter.	......	......	......	......	Cable on small winch parted; 6 fms. cable, 1 wt. (150 lbs.), 1 ball-bearing swivel and 4′ inter. net lost.
54	52.0	......	......	......	Tur. Blish sdr.; 25-lb. lead.	......	......	......	......	
55	52.0	......	......	......	......do......	......	......	......	......	
55	52.0	......	......	......	......do......	......	......	......	......	

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5432	Cape Meares Lt., S. 67½° E., 20.4 miles.	6100	May 4	9.25 a. m.	97	gn. M
H. 5433	Tillamook Lt., N. 46½° E., 25.5 miles.	6100	...do	9.56 a. m.	95	...do
H. 5434	Tillamook Lt., N. 52° E., 25 miles.	6100	...do	10.35 a. m.	95	...do
H. 5435	Tillamook Lt., N. 59° E., 24.9 miles.	6100	...do	11.08 a. m.	95	...do
H. 5436	Tillamook Lt., N. 66½° E., 24.9 miles.	6100	...do	11.41 a. m.	97	...do
H. 5437	Tillamook Lt., N. 73½° E., 25.4 miles.	6100	...do	12.11 p. m.	87	...do
H. 5438	Heceta Head Lt., S. 68° E., 25.2 miles.	6000	May 5	5.01 a. m.	51	Shl., hrd. M
H. 5439	Heceta Lt., S. 69° E., 25.9 miles.	6000	...do	5.21 a. m.	47	fne. bk. S
H. 5440	Heceta Lt., S. 70° E., 26.6 miles.	6000	...do	5.35 a. m.	49	...do
H. 5441	Heceta Lt., S. 70½° E., 27.2 miles.	6000	...do	5.45 a. m.	43	Shl., gran., fne. bk. S.
H. 5442	Heceta Lt., S. 71½° E., 27.9 miles.	6000	...do	5.56 a. m.	49	Shl., rky
H. 5443	Heceta Lt., S. 72° E., 28.6 miles.	6000	...do	6.08 a. m.	50	...do
H. 5444	Heceta Lt., S. 74° E., 28.9 miles.	6000	...do	6.21 a. m.	61	Shl., gran., fne. G.
H. 5445	Heceta Lt., S. 75° E., 29.5 miles.	6000	...do	6.32 a. m.	62	
H. 5446	Heceta Lt., S. 75° E., 28.7 miles.	6000	...do	6.48 a. m.	61	Shl., gran., fne. G.
H. 5447	Heceta Lt., S. 74° E., 29.2 miles.	6000	...do	6.58 a. m.	61	...do
H. 5448	Heceta Lt., S. 73½° E., 28.7 miles.	6000	...do	7.09 a. m.	61	...do
H. 5449	Heceta Lt., S. 70½° E., 29.3 miles.	6000	...do	10.23 a. m.	62	Shl., hrd. M
H. 5450	Heceta Lt., S. 68½° E., 28.6 miles.	6000	...do	10.39 a. m.	65	...do
H. 5451	Heceta Lt., S. 66½° E., 28.7 miles.	6000	...do	11.18 a. m.	54	...do
H. 5452	Heceta Lt., S. 63½° E., 28.7 miles.	6000	...do	12.01 p. m.	65	...do
H. 5453	Heceta Lt., S. 60° E., 29 miles.	6000	...do	12.44 p. m.	72	Shl., gran
H. 5454	Heceta Lt., S. 54° E., 29.7 miles.	6000	...do	1.25 p. m.	79	gn. M
H. 5455	Heceta Lt., S. 48½° E., 30.5 miles.	6000	...do	2.08 p. m.	82	Shl., rky
H. 5456	Heceta Lt., S. 47½° E., 30.7 miles.	6000	...do	2.20 p. m.	78	Shl., hrd. M
H. 5457	Heceta Lt., S. 47½° E., 31.3 miles.	6000	...do	2.38 p. m.	79	...do
H. 5458	Yaquina Lt., N. 70° E., 25.4 miles.	6000	...do	3.22 p. m.	162	gn. M
H. 5459	Yaquina Lt., N. 74½° E., 23.4 miles.	6000	...do	4.08 p. m.	135	...do
H. 5460	Yaquina Lt., N. 81° E., 21.7 miles.	6000	...do	4.53 p. m.	89	Shl., hrd. M
H. 5461	Yaquina Lt., N. 82° E., 21.4 miles.	6000	...do	5.05 p. m.	91	Shl., gran
H. 5462	Yaquina Lt., N. 83° E., 21.2 miles.	6000	...do	5.18 p. m.	92	gn. M
H. 5463	Yaquina Lt., N. 84½° E., 20.8 miles.	6000	...do	5.31 p. m.	89	...do
H. 5464	Yaquina Lt., N. 86° E., 20.6 miles.	6000	...do		85	Shl., hrd. M
H. 5465	Yaquina Lt., N. 87° E., 20.3 miles.	6000	...do	5.55 p. m.	89	...do
H. 5466	Yaquina Lt., N. 88° E., 20 miles.	6000	...do	6.07 p. m.	89	
H. 5467	Yaquina Lt., S. 89° E., 19.8 miles.	6000	...do	6.23 p. m.	91	gn. M
H. 5468	Yaquina Lt., S. 85½° E., 19.7 miles.	6000	...do	6.41 p. m	90	

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
55	52.0				Trn.-Blish sdr.; 25-lb. lead.					
55	52.0				do					
55	52.0				do					
55	52.0				do					
59	52.0				do					
60.5	54.0				do					
52.5	51.0				do					
52.5	51.0				do					
53	51.0				do					
53	51.0				do					
53	51.0				do					
55	51.0				do					
57	51.0				do					
56	51.0				do					
55	51.0				do					
55	51.0				Tnr.-Blish sdr.; 25-lb. lead; 2 skates.	botm	60			One dory lowered; 2 fishermen; steamed ahead 5 minutes; then lowered 2d dory. Salt herring bait.
					Tnr.-Blish sdr.; 25-lb. lead.	do	60			
56	52.0				do					
58	52.0				do					
58	52.0				do					
58	52.0				do					
62	54.0				do					
62	54.0				do					
62	54.0				do					
62	54.0				do					
					do					
					do					
62	54.0				do					
61	54.0				do					
60	54.0				do					
					do					
					do					
					do					
60	52.0				do					
59	52.0				do					
58	52.0				do					
56	51.0				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5469	Yaquina Lt., S. 83½° E., 19.6 miles.	6000	May 5	6.58 p. m.	89	Shl., hrd. M.
H. 5470	Yaquina Lt., S. 81° E., 19.2 miles.	6000	do	7.16 p. m.	90	gn. M.
H. 5471	Yaquina Lt., N. 47° E., 10.5 miles.	6000	May 6	6.36 a. m.	47	crs. gy. S.
H. 5472	Yaquina Lt., N. 50½° E., 10.2 miles.	6000	do	6.55 a. m.	45	crs. gy. S., fne. G.
H. 5473	Yaquina Lt., N. 53½° E., 10.1 miles.	6000	do	7.03 a. m.	45	crs. gy. S., For.
H. 5474	Yaquina Lt., N. 56½° E., 10 miles.	6000	do	7.12 a. m.	44	crs. gy. S.
H. 5475	Yaquina Lt., N. 60½° E., 10 miles.	6000	do	7.19 a. m.	41	do
H. 5476	Yaquina Lt., N. 62° E., 10.3 miles.	6000	do	7.27 a. m.	40	do
H. 5477	Yaquina Lt., N. 63° E., 10.6 miles.	6000	do	7.35 a. m.	38	crs. gy. S., fne. G.
H. 5478	Yaquina Lt., N. 64° E., 10.9 miles.	6000	do	7.41 a. m.	39	Shl., hrd. M.
H. 5479	Yaquina Lt., N. 64½° E., 11.3 miles.	6000	do	7.48 a. m.	35	do
H. 5480	Yaquina Lt., N. 65° E., 11.6 miles.	6000	do	7.55 a. m.	30	Shl., rky., Co.
H. 5481	Yaquina Lt., N. 66° E., 11.9 miles.	6000	do	8.02 a. m.	33	do
H. 5482	Yaquina Lt., N. 67° E., 12.2 miles.	6000	do	8.10 a. m.	38	brk. Sh.
H. 5483	Yaquina Lt., N. 68° E., 12.6 miles.	6000	do	8.16 a. m.	40	Shl., rky.
H. 5484	Yaquina Lt., N. 69° E., 13 miles.	6000	do	8.27 a. m.	44	Shl., hrd. M.
H. 5485	Yaquina Lt., N. 70° E., 13.2 miles.	6000	do	8.36 a. m.	48	fne. bk. S., brk. Sh.
H. 5486	Yaquina Lt., N. 71° E., 13.7 miles.	6000	do	8.47 a. m.	54	do
H. 5487	Yaquina Lt., N. 72° E., 14.5 miles.	6000	do	8.55 a. m.	57	crs. gy. S., brk. Sh.
H. 5488	Yaquina Lt., N. 75½° E., 14.4 miles.	6000	do	11.30 a. m.	64	do
H. 5489	Yaquina Lt., N. 78½° E., 14.4 miles.	6000	do	11.44 a. m.	61	Shl., gran.
H. 5490	Yaquina Lt., N. 81° E., 14.4 miles.	6000	do	11.54 a. m.	61	do
H. 5491	Yaquina Lt., N. 83° E., 14.5 miles.	6000	do	12.07 p. m.	61	Shl., hrd. M.
H. 5492	Yaquina Lt., N. 81° E., 14.4 miles.	6000	do	12.26 p. m.	62	Shl., gran., fne. G.
H. 5493	Yaquina Lt., N. 87½° E., 14.3 miles.	6000	do	5.27 p. m.	76	
H. 5494	Yaquina Lt., S. 88½° E., 13.9 miles.	6000	do	5.33 p. m.	72	fne. bk. S.
H. 5495	Yaquina Lt., S. 85½° E., 12.4 miles.	6000	May 7	4.40 a. m.	52	fne. gy. S.
H. 5496	Yaquina Lt., S. 81° E., 12.6 miles.	6000	do	4.52 a. m.	55	do
H. 5497	Yaquina Lt., S. 76½° E., 12.2 miles.	6000	do	5.09 a. m.	60	do
H. 5498	Yaquina Lt., S. 72° E., 11.8 miles.	6000	do	5.30 a. m.	63	do

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
55.5	51.0				Tnr. Blish sdr.; 25-lb. lead.					
55	51.0				do					
60	52.0				do					
60	52.0				do					
60	52.0				do					
60	52.0				do					
60	52.0				do					
60	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				do					
61	52.0				Tnr.-Blish sdr.; 25-lb. lead; 1 skate.	botm	60			At 8.49 lowered a dory; same returned; hoisted 10.57 a. m.
61	52.0				Tnr.-Blish sdr.; 25-lb. lead; Alb. smp.; 1 skate.	do	60			At 8.55 lowered a dory; had fishing lines over side; dory ret., hoisted 11.18 a. m. Alb. smp. used at 11.15 a. m. Salt herring bait.
53	54.0				Tnr.-Blish sdr.; 25-lb. lead.					
53	54.0				do					
52.5					do					
54	54.0				do					
54	*53.9	17.3 (?)	29.76	33.71	Tnr.-Blish sdr.; 25-lb. lead; P. N. bot.; Alb. smp.; 2 skates.					Lowered 2 dories at 12.26, 2 fishermen each made double bank set; 1st dory ret. 1.54; 2d at 3.01. Line broken about 3 ft. from anchor, dory No. 1. Salt herring bait.
53	52.0				Tnr.-Blish sdr.; 25-lb. lead.					
53	52.0				do					
54	50.0				do					
54	50.0				do					
54	50.0				do					
54	50.0				do					

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		Fms	
H. 5499	Yaquina Lt., S. 66° E., 11.8 miles.	6000	May 7	5.41 a. m.	65	fne. gy. S.
H. 5500	Yaquina Lt., S. 61½° E., 11.8 miles.	6000	...do.....	5.55 a. m.	67	.....do
H. 5501	Yaquina Lt., S. 57° E., 12 miles.	6000	...do.....	6.10 a. m.	69	.....do
H. 5502	Yaquina Lt., S. 52° E., 12.2 miles.	6000	...do.....	6.25 a. m.	71	.....do
H. 5503	Yaquina Lt., S. 48° E., 12.4 miles.	6000	...do.....	6.41 a. m.	71	.....do
H. 5504	Yaquina Lt., S. 43½° E., 12.7 miles.	6000	...do.....	6.55 a. m.	71	.....do
H. 5505	Yaquina Lt., S. 40° E., 13.1 miles.	6000	...do.....	7.09 a. m.	71	.....do
H. 5506	Yaquina Lt., S. 35½° E., 13.2 miles.	6000	...do.....	7.25 a. m.	68	.....do
H. 5507	Yaquina Lt., S. 31½° E., 13.5 miles.	6000	...do.....	7.40 a. m.	65	.....do
H. 5508	Yaquina Lt., S. 27½° E., 13.8 miles.	6000	...do.....	7.54 a. m.	60	.....do
H. 5509	Yaquina Lt., S. 22½° E., 14.1 miles.	6000	...do.....	8.09 a. m.	55	.....do
H. 5510	Yaquina Lt., S. 19° E., 14.8 miles.	6000	...do.....	8.24 a. m.	55	.....do
H. 5511	Yaquina Lt., S. 15° E., 15.3 miles.	6000	...do.....	8.37 a. m.	60	.....do
H. 5512	Yaquina Lt., S. 11½° E., 16.4 miles.	6000	...do.....	8.53 a. m.	53	.....do
H. 5513	Yaquina Lt., S. 10½° E., 17.2 miles.	6000	...do.....	9.03 a. m.	51	.....do
H. 5514	Yaquina Lt., S. 8½° E., 18.1 miles.	6000	...do.....	9.20 a. m.	49	.....do
H. 5515	Yaquina Lt., S. 7° E., 19 miles.	6000	...do.....	9.33 a. m.	45	.....do
H. 5516	Yaquina Lt., S. 5½° E., 19.8 miles.	6000	...do.....	9.50 a. m.	46	.....do
H. 5517	Cape Kiwanda, N. 26½° E., 13.3 miles.	6000	...do.....	10.05 a. m.	48	.....do
H. 5518	Cape Kiwanda, N. 29° E., 12.7 miles.	6000	...do.....	10.17 a. m.	48	.....do
H. 5519	Cape Kiwanda, N. 31½° E., 11.8 miles.	6000	...do.....	12.23 p. m.	51	.....do
H. 5520	Cape Kiwanda, N. 33½° E., 11 miles.	6000	...do.....	12.40 p. m.	51	.....do
H. 5521	Cape Kiwanda, N. 36½° E., 10.2 miles.	6000	...do.....	12.57 p. m.	49	crs. S., fne. G
H. 5522	Cape Kiwanda, N. 39½° E., 9.5 miles.	6000	...do.....	1.13 p. m.	48	fne. gy. S
H. 5523	Cape Kiwanda, N. 43½° E., 8.8 miles.	6000	...do.....	1.29 p. m.	47	.....do
H. 5524	Cape Kiwanda, N. 44½° E., 7.4 miles.	6000	...do.....	1.44 p. m.	44	.....do
H. 5525	Cape Kiwanda, N. 47° E., 6.5 miles.	6000	...do.....	2.00 p. m.	42	.....do
H. 5526	Cape Kiwanda, N. 51° E., 5.5 miles.	6000	...do.....	2.07 p. m.	40	.....do
H. 5527	Cape Kiwanda, N. 55½° E., 4 4 miles.	6000	...do.....	2.18 p. m.	34	.....do
H. 5528	Cape Kiwanda, N. 80½° E., 5.5 miles.	6000	...do.....	3.01 p. m.	50	.....do
H. 5529	Cape Kiwanda, S. 87½° E., 5.4 miles.	6000	...do.....	3.17 p. m.	52	.....do
H. 5530	Cape Kiwanda, S. 77° E., 5.5 miles.	6000	...do.....	3.32 p. m.	50	.....do

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
54	50.0				Tur.-Blish.sdr.; 25-lb. lead.					
54	50.0				do					
54	50.0				do					
54	50.0				do					
54	50.0				do					
54	50.0				do					
54	50.0				do					
54	50.0				do					
					do					
54	52.0				do					
54	52.0				do					
54	52.0				do					
54	52.0				do					
55	54.0				do					
55	54.0				do					
55	54.0				do					
55	54.0				do					
55	54.0				do					
55	54.0				do					
	*53.1		30.17	33.87	Tnr.-Blish.sdr.; 25-lb. lead; P. N. bot.; Alb. smp.; 2 skates.	botm.	60			At 10.17 lowered both dories. At 10.50 sounded in 50 fms. and put over P. N. bot. with 82 m. cable; down 5 min., sent messenger and hove up. Bot. therm. failed to register. At 11.54 used Alb. smp. 1st dory ret. 12.07; 2d at 12.10. Salt herring bait.
53	54.0				Tnr.-Blish.sdr.; 25-lb. lead.					
53	54.0				do					
54.5	54.0				do					
54	54.0				do					
54	54.0				do					
54	54.0				do					
54	54.0				do					
54	54.0				do					
					do					
54	54.0				do					
54	54.0				do					
54	54.0				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5531	Cape Kiwanda, S. 66° E., 5.5 miles.	6000	May 7	3.50 p. m.	48	fne. gy. S..........
H. 5532	Cape Kiwanda, S. 59½° E., 6.2 miles.	6000	...do.....	4.04 p. m.	49	.....do.............
H. 5533	Cape Kiwanda, S. 51° E., 6.8 miles.	6000	...do.....	4.27 p. m.	47	.....do.............
H. 5534	Cape Meares Lt., N. 29½° E., 10.5 miles.	6100	...do.....	4.52 p. m.	48	.....do.............
H. 5535	Cape Meares Lt., N. 40° E., 8.8 miles.	6100	...do.....	5.22 p. m.	51	.....do.............
H. 5536	Cape Meares Lt., N. 59½° E., 7.8 miles.	6100	...do.....	6.02 p. m.	56	.....do.............
H. 5537	Cape Meares Lt., N. 80° E., 7.1 miles.	6100	...do.....	6.39 p. m.	59	.....do.............
H. 5538	Cape Meares Lt., N. 87° E., 7.8 miles.	6100	...do.....	6.56 p. m.	62	....
H. 5539	Cape Meares Lt., S. 86½° E., 8 miles.	6100	...do.....	7.07 p. m.	62	....
H. 5540	Cape Meares Lt., S. 65½° E., 8.1 miles.	6100	...do.....	7.37 p. m.	57	fne. gy. S..........
H. 5541	Cape Meares Lt., S. 48° E., 9.3 miles.	6100	...do.....	8.06 p. m.	55	.....do.............
H. 5542	Cape Meares Lt., S. 36° E., 11 miles.	6100	May 8	6.30 a. m.	51	.....do.............
H. 5543	Cape Meares Lt., S. 26° E., 13.2 miles.	6100	...do.....	6.57 a. m.	48	.....do.............
H. 5544	Tillamook Lt., N. 17½° E., 13.2 miles.	6100	...do.....	7.30 a. m.	47	.....do.............
H. 5545	Tillamook Lt., N. 26½° E., 11 miles.	6100	...do.....	7.57 a. m.	50	.....do.............
H. 5546	Tillamook Lt., N. 38° E., 8.8 miles.	6100	...do.....	8.22 a. m.	52	Shl., hrd. M.......
H. 5547	Tillamook Lt., N. 57½° E., 7.3 miles.	6100	...do.....	8.50 a. m.	52	fne. gy. S..........
H. 5548	Tillamook Lt., N. 71° E., 9.7 miles.	6100	...do.....	9.24 a. m.	62	....
H. 5549	Tillamook Lt., N. 73½° E., 10.5 miles.	6100	...do.....	9.37 a. m.	66	gn. M.............
H. 5550	Tillamook Lt., N. 75° E., 11.4 miles.	6100	...do.....	9.51 a. m.	68	.....do.............
H. 5551	Tillamook Lt., N. 77½° E., 12.4 miles.	6100	...do.....	10.06 a. m.	72	.....do.............
H. 5552	Tillamook Lt., N. 78° E., 13.4 miles.	6100	...do.....	10.19 a. m.	75	.....do.............
H. 5553	Tillamook Lt., N. 82° E., 16.3 miles.	6100	...do.....	10.52 a. m.	79	.....do.............
H. 5554	Tillamook Lt., N. 84° E., 19.2 miles.	6100	...do.....	11.28 a. m.	83	.....do.............
H. 5555	Tillamook Lt., N. 86° E., 22.2 miles.	6100	...do.....	12.00 noon.	86	Shl., rky..........
H. 5556	Tillamook Lt., N. 87° E., 25.1 miles.	6100	...do.....	12.34 p. m.	78	.....do.............
H. 5557	Tillamook Lt., N. 87½° E., 25.6 miles.	6100	...do.....	12.43 p. m.	94	gn. M.............
H. 5558	Tillamook Lt., N. 87° E., 25.1 miles.	6100	...do.....	1.03 p. m.	79	Shl., gran.........
H. 5559	Tillamook Lt., S. 86½° E., 25.3 miles.	6100	...do.....	3.43 p. m.	83	gn. M.............
H. 5560	Tillamook Lt., S. 79½° E., 25.9 miles.	6100	...do.....	4.16 p. m.	85	.....do.............
H. 5561	Tillamook Lt., S. 73½° E., 26.9 miles.	6100	...do.....	4.51 p. m.	81	.....do.............
H. 5562	Tillamook Lt., S. 68° E., 28.2 miles.	6100	...do.....	5.23 p. m.	88	.....do.............
H. 5563	Tillamook Lt., S. 66° E., 28.8 miles.	6100	...do.....	5.34 p. m.	89	.....do.............
H. 5564	Tillamook Lt., S. 64° E., 29.3 miles.	6100	...do.....	5.54 p. m.	95	.....do.............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
54	54.0	......	......	......	Tnr.-Blish sdr.; 25-lb lead.	......	......	......	......	
55	54.0	......	......	......	do	......	......	......	......	
55	54.0	......	......	......	do	......	......	......	......	
54	53.0	......	......	......	do	......	......	......	......	
54	53.0	......	......	......	do	......	......	......	......	
53	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
53	53.0	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
54	53.0	......	......	......	do	......	......	......	......	
54	55.0	......	......	......	do	......	......	......	......	
56.5	55.0	......	......	......	do	......	......	......	......	
56	55.0	......	......	......	do	......	......	......	......	
56.5	53.5	......	......	......	do	......	......	......	......	
56	53.5	......	......	......	do	......	......	......	......	
56	53.5	......	......	......	do	......	......	......	......	
56	53.5	......	......	......	do	......	......	......	......	
56	53.5	......	......	......	do	......	......	......	......	
57	53.5	......	......	......	do	......	......	......	......	
56	54.0	......	......	......	do	......	......	......	......	
57	54.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	......	......	do	......	......	......	......	
55	52.0	......	30.52	32.79	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; Alb. smp.; 2 skates.	botm...	60	......	......	Location approximately same as H. 5556. At 1.11 lowered f'wd dory, which ret. 3.05 p. m. Lowered aft dory at 1.14; ret. 3.02 p. m. Salt herring bait.
54	54.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
54	54.0	......	......	......	do	......	......	......	......	
54	54.0	......	......	......	do	......	......	......	......	
54	52.0	......	......	......	do	......	......	......	......	
54	54.0	......	......	......	do	......	......	......	......	
54	54.0	......	......	......	do	......	......	......	......	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5565	Yaquina Lt., N. 23½° E., 7.7 miles.	6000	May 27	3.06 p. m.	24	fne. gy. S........
H. 5566	Yaquina Lt., N. 25½° E., 8.9 miles.	6000	...do.....	3.16 p. m.	29	.....do...........
H. 5567	Yaquina Lt., N. 25½° E., 9.9 miles.	6000	...do.....	3.26 p. m.	30	.....do...........
H. 5568	Yaquina Lt., N. 26° E., 10.8 miles.	6000	...do.....	3.35 p. m.	31	.....do...........
H. 5569	Yaquina Lt., N. 27° E., 11.5 miles.	6000	...do.....	3.46 p. m.	34	.....do...........
H. 5570	Yaquina Lt., N. 27° E., 13.2 miles.	6000	...do.....	5.38 p. m.	34	.....do...........
H. 5571	Yaquina Lt., N. 28½° E., 16.1 miles.	6000	...do.....	6.06 p. m.	38	.....do...........
H. 5572	Yaquina Lt., N. 31° E., 19.2 miles.	6000	...do.....	6.31 p. m.	39	.....do...........
H. 5573	Yaquina Lt., N. 30° E., 22.4 miles.	6000	...do.....	6.53 p. m.	40	.....do...........
H. 5574	Heceta Lt., S. 45° E., 14.9 miles.	6000	...do.....	7.17 p. m.	44	.....do...........
H. 5575	Heceta Lt., S. 56½° E., 14.6 miles.	6000	...do.....	7.40 p. m.	50	.....do...........
H. 5576	Heceta Lt., S. 68½° E., 15.1 miles.	6000	...do.....	8.03 p. m.	55	.....do...........
H. 5577	Heceta Lt., S. 79½° E., 15.8 miles.	6000	May 28	7.40 a. m.	56	.....do...........
H. 5578	Heceta Lt., S. 88° E., 17.1 miles.	6000	...do.....	8.07 a. m.	61	gn. M............
H. 5579	Heceta Lt., N. 84½° E., 19 miles.	6000	...do.....	8.32 a. m.	66	.....do...........
H. 5580	Heceta Lt., N. 78° E., 21 miles.	6000	...do.....	8.57 a. m.	60	....
H. 5581	Heceta Lt., N. 76° E., 21.8 miles.	6000	...do.....	9.10 a. m.	65	Shl., gran........
H. 5582	Heceta Lt., N. 74½° E., 22.3 miles.	6000	...do.....	9.20 a. m.	61	Shl., rky.........
H. 5583	Heceta Lt., N. 73° E., 23.1 miles.	6000	...do.....	9.27 a. m.	64	crs. bk. S.........
H. 5584	Heceta Lt., N. 71½° E., 24 miles.	6000	...do.....	9.37 a. m.	55	.....do...........
H. 5585	Heceta Lt., N. 70° E., 24.8 miles.	6000	...do.....	9.50 a. m.	58	.....do...........
H. 5586	Heceta Lt., N. 69° E., 25.5 miles.	6000	...do.....	10.02 a. m.	56	Shl., rky.........
H. 5587	Heceta Lt., N. 68° E., 26.1 miles.	6000	...do.....	10.17 a. m.	59	Shl., gran........
H. 5588	Heceta Lt., N. 67° E., 27 miles.	6000	...do.....	10.29 a. m.	61	....
H. 5589	Heceta Lt., N. 65½° E., 27.8 miles.	6000	...do.....	10.40 a. m.	66	Shl., gran........
H. 5590	Heceta Lt., N. 65° E., 28.3 miles.	6000	...do.....	10.49 a. m.	68	.....do...........
H. 5591	Heceta Lt., N. 64° E., 29.3 miles.	6000	...do.....	1.20 p. m.	79	Shl., hrd. M.......
H. 5592	Heceta Lt., N. 62½° E., 30.2 miles.	6000	...do.....	1.35 p. m.	133	Shl., gran.; bk. S ..
H. 5593	Heceta Lt., N. 64° E., 30.5 miles.	6000	...do.....	1.48 p. m.	133	fne. bk. S., fne. G ..

Investigations off Oregon-Washington Coasts, 1914 and 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
57	54.0	......	......	......	Tnr.-Blish sdr.; 25-lb lead.	......	......	......	.....	
56.5	54.0	......	......	......	....do......	......	......	......	.....	
56	54.0	......	......	......	....do......	......	......	......	.....	
56	54.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead; 1 skate.	botm...	60	......	.....	Lowered f'wd dory with 2 fishermen at 3.40 p. m.; hoisted at 5.27 p. m. Salt herring bait.
....	55.0	......	30.25	33.64	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; Alb. smp.; 1 skate.	...do....	60	......	.....	Lowered aft dory with 2 fishermen at 3.49; hoisted dory at 5.32. Ek. bot. lowered to 27 fms. Alb. smp.; no sample at 34 fms. Salt herring bait.
56	53.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	.....	
56	53.0	......	......	......	....do......	......	......	......	.....	
55	54.0	......	......	......	....do......	......	......	......	.....	
55	54.0	......	......	......	....do......	......	......	......	.....	
55	54.0	......	......	......	....do......	......	......	......	.....	
53	54.0	......	......	......	....do......	......	......	......	.....	
53	54.0	......	......	......	....do......	......	......	......	.....	
57	51.0	......	......	......	....do......	......	......	......	.....	
57	51.0	......	......	......	....do......	......	......	......	.....	
58	51.0	......	......	......	....do......	......	......	......	.....	
58	51.0	......	......	......	....do......	......	......	......	.....	
58	51.0	......	......	......	....do......	......	......	......	.....	
58	51.0	......	......	......	....do......	......	......	......	.....	
58	51.0	......	......	......	....do......	......	......	......	.....	
58	51.0	......	......	......	....do......	......	......	......	.....	
56	53.0	......	......	......	....do......	......	......	......	.....	
56	54.0	......	......	......	....do......	......	......	......	.....	
56	54.0	......	......	......	....do......	......	......	......	.....	
56	54.0	......	......	......	....do......	......	......	......	.....	
55.5	*53.9	......	......	......	Tnr.-Blish sdr.; 25-lb. lead; 1 skate.	botm...	60	......	.....	Lowered f'wd dory at 10.54; hoisted at 1.07 p. m. Lowered aft dory at 11.05; hoisted at 1 p. m. Salt herring bait.
55.1	54.0	......	31.64	33.82	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; Alb. smp.	...do....	60	......	.....	
58	54.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	.....	
58	54.0	......	......	......	....do......	......	......	......	.....	
56	54.0	......	......	......	....do......	......	......	......	.....	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5594	Heceta Lt., N. 63° E., 30 miles.	6000	May 28	2.10 p. m.	109	fne. bk. S., fne. G.
H. 5595	Heceta Lt., N. 63° E., 28.8 miles.	6000	...do.....	4.43 p. m.	115	Shl., rky.; bk. S...
H. 5596	Heceta Lt., N. 63° E., 27.9 miles.	6000	...do.....	5.00 p. m.	115	gn. M., bk. S.......
H. 5597	Heceta Lt., N. 63° E., 24.9 miles.	6000	...do.....	5.40 p. m.	79	Shl., hrd. M.......
H. 5598	Heceta Lt., N. 63° E., 21.8 miles.	6000	...do.....	6.18 p. m.	84	gn. M.............
H. 5599	Heceta Lt., N. 63° E., 18.7 miles.	6000	...do.....	6.55 p. m.	94	.....do.............
H. 5600	Heceta Lt., N. 63° E., 15.6 miles.	6000	...do.....	7.32 p. m.	95	.....do.............
H. 5601	Heceta Lt., N. 63° E., 12.6 miles.	6000	...do.....	8.08 p. m.	82	....
H. 5602	Heceta Lt., S. 74½° E., 7.8 miles.	6000	May 29	4.23 a. m.	46	fne. gy. S..........
H. 5603	Heceta Lt., S. 85° E., 10.4 miles.	6000	...do.....	4.59 a. m.	55	.....do.............
H. 5604	Heceta Lt., E., 13 miles.....	6000	...do.....	5.36 a. m.	63	....
H. 5605	Heceta Lt., N. 86½° E., 15.7 miles.	6000	...do.....	6.14 a. m.	70	gn. M.............
H. 5606	Heceta Lt., N. 84° E., 18.7 miles.	6000	...do.....	6.51 a. m.	75	.....do.............
H. 5607	Heceta Lt., N. 82½° E., 21.4 miles.	6000	...do.....	7.28 a. m.	68	fne. G., bk. S......
H. 5608	Heceta Lt., N. 81½° E., 22.5 miles.	6000	...do.....	7.43 a. m.	62	.....do.............
H. 5609	Heceta Lt., N. 81° E., 23.9 miles.	6000	...do.....	7.57 a. m.	65	Shl., rky.; fne. G...
H. 5610	Heceta Lt., N. 80½° E., 24.8 miles.	6000	...do.....	8.13 a. m.	75	Shl. gran., fne. G.
H. 5611	Heceta Lt., N. 80° E., 27.6 miles.	6000	...do.....	8.50 a. m.	67	.....do.............
H. 5612	Heceta Lt., N. 79½° E., 28.1 miles.	6000	...do.....	9.00 a. m.	67	Shl., hrd. M.......
H. 5613	Heceta Lt., N. 79° E., 29.2 miles.	6000	...do.....	9.16 a. m.	70	.....do.............
H. 5614	Heceta Lt., N. 78½° E., 30.2 miles.	6000	...do.....	9.32 a. m.	71	.....do.............
H. 5615	Heceta Lt., N. 80° E., 31.4 miles.	6000	...do.....	9.47 a. m.	79	.....do.............
H. 5616	Heceta Lt., N. 78° E., 32.7 miles.	6000	...do.....	10.01 a. m.	100	bk. S., fne. G......
H. 5617	Heceta Lt., N. 77° E., 33 miles.	6000	...do.....	10.17 a. m.	170	....
H. 5618	Heceta Lt., N. 76° E., 32.3 miles.	6000	...do.....	10.49 a. m.	124	fne. Gr............
H. 5619	Heceta Lt., N. 77½° E., 31.6 miles.	6000	...do.....	11.10 a. m.	100	fne. bk. S.........
H. 5620	Umpqua River Lt., N. 66½° E., 9.8 miles.	6000	Aug. 29	9.24 a. m.	74	....
H. 5621	Umpqua River Lt., N. 56° E., 9 miles.	6000	...do.....	11.55 a. m.	65	Shl., gran., fne. G.
H. 5622	Umpqua River Lt., N. 43° E., 8.3 miles.	6000	...do.....	1.00 p. m.	55	fne. gy. S.........
H. 5623	Umpqua River Lt., N. 36° E., 8.2 miles.	6000	...do.....	1.15 p. m.	45	.....do.............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
56	*54. 1	......	31. 71	......	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; Alb. smp.; 2 skates.	botm...	60	......	......	Lowered aft dory at 2.19 with 2 fishermen; hoisted at 4.22. Lowered f'wd dory at 2.20; hoisted at 4.15 p. m. Ek. bot. lowered to 190 m.; did not trip until hauled up to 90 m. Salt herring bait.
57	54. 0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
57	54. 0	......	......	......	do	......	......	......	......	
57	54. 0	......	......	......	do	......	......	......	......	
57	54. 0	......	......	......	do	......	......	......	......	
56	53. 0	......	......	......	do	......	......	......	......	
53	52. 0	......	......	......	do	......	......	......	......	
53	52. 0	......	......	......	do	......	......	......	......	
53	50. 0	......	......	......	do	......	......	......	......	
53	50. 0	......	......	......	do	......	......	......	......	
53. 5	50. 0	......	......	......	do	......	......	......	......	
54	50. 0	......	......	......	do	......	......	......	......	
55	50. 0	......	......	......	do	......	......	......	......	
55	50. 0	......	......	......	do	......	......	......	......	
55	50. 0	......	......	......	do	......	......	......	......	
56	52. 0	......	......	......	do	......	......	......	......	
56	52. 0	......	......	......	do	......	......	......	......	
56	52. 0	......	......	......	do	......	......	......	......	
56	52. 0	......	......	......	do	......	......	......	......	
58	52. 0	......	......	......	do	......	......	......	......	
58	52. 0	......	......	......	do	......	......	......	......	
58	52. 0	......	......	......	do	......	......	......	......	
59	52. 0	......	......	......	do	......	......	......	......	
58	52. 0	......	......	......	do	......	......	......	......	
56	52. 0	......	......	......	do	......	......	......	......	
....	......	......	32. 03	......	Tnr.-Blish sdr.; 25-lb. lead; Alb. smp.; 2 skates.	botm...	60	......	......	Lowered f'wd dory at 11.15; hoisted at 1.22 p. m.; lowered aft dory at 11.16; hoisted at 1.23 p. m.; 2 fishermen in each. Salt herring bait.
53	47. 0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
52	47. 0	......	......	......	do	......	......	......	......	
53. 5	......	......	......	......	do	......	......	......	......	
53	......	......	......	......	do	......	......	......	......	

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5624	Umpqua River Lt., N. 28½° E., 8.2 miles.	6000	Aug. 29	1.50 p. m.	36	fne. gy. S.........
H. 5625	Cape Arago Lt., S. 71° E., 2.5 miles.	6000	Aug. 30	7.28 a. m.	39	.....do............
H. 5626	Cape Arago Lt., S. 85° E., 3.3 miles.	6000	...do.....	7.38 a. m.	45	.....do............
H. 5627	Cape Arago Lt., N. 87° E., 4.1 miles.	6000	...do.....	7.50 a. m.	44	.....do............
H. 5628	Cape Arago Lt., N. 82° E., 5 miles.	6000	...do.....	8.01 a. m.	47	.....do............
H. 5629	Cape Arago Lt., N. 78° E., 6 miles.	6000	...do.....	8.12 a. m.	56	.....do............
H. 5630	Cape Arago Lt., N. 75° E., 6.9 miles.	6000	...do.....	8.23 a. m.	57	....
H. 5631	Cape Arago Lt., N. 73½° E., 8 miles.	6000	...do.....	8.35 a. m.	59	Shl., hrd. M........
H. 5632	Cape Arago Lt., N. 72° E., 9 miles.	6000	...do.....	9.12 a. m.	65	Shl., gran.........
H. 5633	Cape Arago Lt., S. 20½° E., 2.7 miles.	6000	...do.....	1.56 p. m.	30	fne. gy. S.........
H. 5634	Cape Arago Lt., S. 28° E., 3.6 miles.	6000	...do.....	2.10 p. m.	45	.....do............
H. 5635	Cape Arago Lt., S. 34° E., 4.6 miles.	6000	...do.....	2.22 p. m.	48	.....do............
H. 5636	Cape Arago Lt., S. 37½° E., 5.6 miles.	6000	...do	2.34 p. m.	56	.....do............
H. 5637	Cape Arago Lt., S. 40° E., 6.4 miles.	6000	...do.....	2.46 p. m.	60	....
H. 5638	Cape Arago Lt., S. 41° E., 7.5 miles.	6000	...do.....	2.58 p. m.	62	fne. gy. S.........
H. 5639	Cape Arago Lt., S. 43° E., 8.5 miles.	6000	...do.....	3.08 p. m.	66	.....do............
H. 5640	Cape Arago Lt., S. 44° E., 9.6 miles.	6000	...do.....	3.21 p. m.	63	....
H. 5641	Cape Arago Lt., S. 45° E., 10.5 miles.	6000	...do.....	3.33 p. m.	78	....
H. 5642	Cape Arago Lt., N. 58° E., 9.1 miles.	6000	...do.....	5.52 p. m.	52	Shl., gran.........
H. 5643	Cape Arago Lt., N. 51° E., 9.3 miles.	6000	...do.....	6.04 p. m.	46	fne. G............
H. 5644	Cape Arago Lt., N. 45½° E., 9.5 miles.	6000	...do.....	6.16 p. m.	38	Shl., hrd. M.......
H. 5645	Cape Arago Lt., N. 40° E., 9.9 miles.	6000	...do.....	6.26 p. m.	42	fne. G............
H. 5646	Cape Arago Lt., N. 34° E., 10.3 miles.	6000	...do.....	6.36 p. m.	38	Shl., rky., Co.......
H. 5647	Cape Arago Lt., N. 29° E., 10.8 miles.	6000	...do.....	6.47 p. m.	34	Shl., gran.........
H. 5648	Cape Arago Lt., S. 1° E., 3.3 miles.	6000	Aug. 31	5.21 a. m.	28	fne. gy. S.........
H. 5649	Cape Arago Lt., S. 1° E., 4.4 miles.	6000	...do.....	5.37 a. m.	38	.....do............
H. 5650	Cape Arago Lt., S. 2½° E., 5.5 miles.	6000	...do.....	5.56 a m.	47	.....do............
H. 5651	Cape Arago Lt., S. 5° W., 8.2 miles.	6000	...do.....	9.20 a. m.	58	.....do............
H. 5652	Cape Arago Lt., S. 9° W., 11.2 miles.	6000	...do.....	9.46 a. m.	71	.....do............
H. 5653	Umpqua River Lt., N. 43° E., 7.6 miles.	6000	...do.....	10.13 a. m.	55	fne. gy. S., gn. M...

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
53	*48.2	......	33.78	33.68	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; 2 skates.	botm...	120	....	.....	Lowered f'wd dory at 1.24; hoisted at 4.05 p. m. Lowered aft dory at 1.24; hoisted at 4.10 p. m. Ek. bot. lowered at 1.40; up at 1.45. Fresh salmon bait.
54	44.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	....	......	....	.....	
54	44.0	......	......	......	....do....	....	......	....	.....	
55	44.0	......	......	......	....do....	....	......	....	.....	
55	45.0	......	......	......	....do....	....	......	....	.....	
55	45.0	......	......	......	....do....	....	......	....	.....	
55	45.0	......	......	......	....do....	....	......	....	.....	
57	45.0	......	......	......	....do....	....	......	....	.....	
57	*52.5	......	33.78	32.90	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; 2 skates.	botm...	120	....	.....	Both dories out 8.51 a. m.; f'wd dory in 11.59, aft dory in 12.11 p. m. Fresh salmon bait.
58	46.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead; 2 skates.	...do....	120	....	.....	Both dories out 1.50; f'wd dory in 4.41, aft dory in 4.43. Temp. taken at 4.30. Fresh salmon bait.
....	.....	......	......	......	....do....	....	......	....	.....	
....	.....	......	......	......	....do....	....	......	....	.....	
....	.....	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	....	......	....	.....	
....	.....	......	......	......	....do....	....	......	....	.....	
....	.....	......	......	......	....do....	....	......	....	.....	
....	.....	......	......	......	....do....	....	......	....	.....	
....	.....	......	......	......	....do....	....	......	....	.....	
....	.....	......	......	......	....do....	....	......	....	.....	
53	47.0	......	......	......	....do....	....	......	....	.....	
52	47.0	......	......	......	....do....	....	......	....	.....	Temp. taken at 6.09 p. m.
53	47.0	......	......	......	....do....	....	......	....	.....	
53	47.0	......	......	......	....do....	....	......	....	.....	
53	47.0	......	......	......	....do....	....	......	....	.....	
53	47.0	......	......	......	....do....	....	......	....	.....	
47	45.0	......	......	......	....do....	....	......	....	.....	
47	45.0	......	......	......	....do....	....	......	....	.....	
47	45.0	......	33.57	......	Tnr.-Blish sdr.; 25-lb. lead; 2 skates.	botm...	120	....	.....	F'wd dory out, 5.50; in, 8.39. Aft dory out, 5.51; in, 8.46. Fresh salmon bait.
55	46.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	....	......	....	.....	
55	46.0	......	......	......	....do....	....	......	....	.....	
56	46.0	......	......	......	....do....	....	......	....	.....	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character o bottom.
		C. S.	1914.		*Fms.*	
H. 5654	Umpqua River Lt., N. 57° E., 5 miles.	6000	Aug. 31	10.38 a. m.	55	gn. M............
H. 5655	Umpqua River Lt., S. 87° E., 3.2 miles.	6000	...do.....	11.05 a. m.	51	.....do............
H. 5656	Umpqua River Lt., S. 45° E., 4.6 miles.	6000	...do.....	11.30 a. m.	51	.....do............
H. 5657	Umpqua River Lt., S. 26½° E., 7.1 miles.	6000	...do.....	12.00 noon.	53	.....do............
H. 5658	Umpqua River Lt., S. 19° E., 9.8 miles.	6000	...do.....	12.26 p. m.	54	.....do............
H. 5659	Umpqua River Lt., S. 14° E., 12.7 miles.	6000	...do.....	12.47 p. m.	55	.....do............
H. 5660	Umpqua River Lt., S. 11° E., 15.6 miles.	6000	...do.....	1.15 p. m.	55	....
H. 5661	Umpqua River Lt., S. 9½° E., 18.6 miles.	6000	...do.....	1.41 p. m.	48	fne. gy. S..........
H. 5662	Heceta Lt., N. 29½° E., 11.25 miles.	6000	...do.....	1.50 p. m.	47	.....do............
H. 5663	Heceta Lt., N. 28½° E., 10.8 miles.	6000	...do.....	2.00 p. m.	42	.....do............
H. 5664	Heceta Lt., N. 30½° E., 9.8 miles.	6000	...do....	5.12 p. m.	41	Shl., gran., crs. G., fne. G., fne. gy. S.
H. 5665	Heceta Lt., N. 37½° E., 6.9 miles.	6000	...do.....	5.40 p. m.	35	fne. gy. S.........
H. 5666	Heceta Lt., N. 53° E., 4.3 miles.	6000	...do.....	6.10 p. m.	33	.....do............
H. 5667	Heceta Lt., N. 87½° E., 2.8 miles.	6000	...do.....	6.38 p. m.	31	.....do............
H. 5668	Heceta Lt., N. 82° E., 26.9 miles.	6000	Sept. 1	5.20 a. m.	56	Shl., hrd. M.......
H. 5669	Heceta Lt., N. 82° E., 27.9 miles.	6000	...do.....	5.31 a. m.	52	.....do............
H. 5670	Heceta Lt., N. 82° E., 29 miles.	6000	...do.....	5.41 a. m.	55	.....do............
H. 5671	Heceta Lt., N. 82° E., 30.1 miles.	6000	...do.....	5.53 a. m.	65	.....do............
H. 5672	Heceta Lt., N. 82° E., 31.3 miles.	6000	...do.....	6.04 a. m.	83	Shl., rky..........
H. 5673	Heceta Lt., N. 82° E., 31.8 miles.	6000	...do.....	6.12 a. m.	114	fne. bk. S.........
H. 5674	Heceta Lt., N. 80½° E., 31.5 miles.	6000	...do.....	6.31 a. m.	84	Shl., hrd. M.......
H. 5675	Heceta Lt., N. 78½° E., 31.2 miles.	6000	...do.....	6.46 a. m.	80	Shl., rky., gran...
H. 5676	Heceta Lt., N. 78½° E., 31.7 miles.	6000	...do.....	6.57 a. m.	93	crs. bk. S., fne. G..
H. 5677	Heceta Lt., N. 78½° E., 32.2 miles.	6000	...do.....	7.10 a. m.	131	fne. bk. S.........
H. 5678	Heceta Lt., N. 79½° E., 32.1 miles.	6000	...do.....	7.22 a. m.	139	.....do............
H. 5679	Heceta Lt., N. 79½° E., 31.7 miles.	6000	...do.....	7.35 a. m.	88	Shl., gran., fne. G.
H. 5680	Heceta Lt., N. 79° E., 31.2 miles.	6000	...do.....	7.47 a. m.	71	crs. S., For........
H. 5681	Heceta Lt., N. 79° E., 31.4 miles.	6000	...do.....	8.00 a. m.	82	Shl., gran., fne. bk. S.
H. 5682	Heceta Lt., N. 84½° E., 31.2 miles.	6000	...do.....	11.28 a. m.	83	Shl., hrd. M.......
H. 5683	Heceta Lt., N. 89° E., 31.1 miles.	6000	...do.....	11.56 a. m.	80	.....do............
H. 5684	Heceta Lt., S. 86° E., 31.3 miles.	6000	...do.....	12.20 p. m.	68	.....do............
H. 5685	Heceta Lt., S. 81½° E., 31.8 miles.	6000	...do.....	12.55 p. m.	71	Shl., rky., bk. S...
H. 5686	Heceta Lt., S. 79½° E., 32 miles.	6000	...do.....	1.08 p. m.	77	fne. bk. S.........
H. 5687	Heceta Lt., S. 77½° E., 32.2 miles.	6000	...do.....	1.23 p. m.	80	Shl., gran., fne. bk. S.

Investigations off Oregon-Washington Coasts, 1914 and 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
56	46.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
59	47.0	......	......	......	do	......	......	......	......	
59	47.0	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
......	......	......	......	......	do	......	......	......	......	
62	*48.8	46.4	33.62	33.53	Tnr.-Blish sdr.; 25-lb. lead; Ek. bot.; 2 skates.	botm...	120	......	......	Temp. taken at 4.55. F'wd dory out 2.06; in, 4.53. Aft dory out, 2.06; in, 4.50.
56	47.0	......	......	......	Tnr.-Blish sdr.; 25-lb. lead.	......	......	......	......	
62	47.0	......	......	......	do	......	......	......	......	
62	47.0	......	......	......	do	......	......	......	......	
62	47.0	......	......	......	do	......	......	......	......	
50	42.0	......	......	......	do	......	......	......	......	
50	42.0	......	......	......	do	......	......	......	......	
50	42.0	......	......	......	do	......	......	......	......	
50	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
51	42.0	......	......	......	do	......	......	......	......	
58	*57.2	46.65	33.93	31.73	Tnr.-Blish sdr.; 32-lb. lead; Ek. bot.; 2 skates.	botm...	120	......	......	F'wd dory out, 8.05; in, 11.01. Aft dory out, 8.05; in, 11.03. Fresh salmon bait. Temp. taken at 8.30.
......	......	......	......	......	Tnr.-Blish sdr.; 32-lb. lead.	......	......	......	......	
59	54.0	......	......	......	do	......	......	......	......	Temp. taken at 12.01.
59	54.0	......	......	......	do	......	......	......	......	
59.5	54.0	......	......	......	do	......	......	......	......	
59	54.0	......	......	......	do	......	......	......	......	
59	54.0	......	......	......	do	......	......	......	......	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5688	Heceta Lt., S. 76° E., 32.6 miles.	6000	Sept. 1	1.33 p. m.	92	bk. S
H. 5689	Heceta Lt., S. 76° E., 32.1 miles.	6000	...do.....	1.39 p. m.	87	Shl., rky., hrd. M., fne. bk. S.
H. 5690	Heceta Lt., S. 73° E., 29.6 miles.	6000	...do.....	5.05 p. m.	82	fne. bk. S
H. 5691	Heceta Lt., S. 69° E., 27.8 miles.	6000	...do.....	5.30 p. m.	62	Shl., hrd. M
H. 5692	Heceta Lt., S. 64° E., 25.8 miles.	6000	...do.....	5.57 p. m.	55	Shl., rky.; Co.
H. 5693	Heceta Lt., S. 58° E., 24.2 miles.	6000	...do.....	6.21 p. m.	51	Shl., rky
H. 5694	Heceta Lt., S. 51° E., 22.9 miles.	6000	...do.....	6.47 p. m.	54	Shl., hrd. M
H. 5695	Yaquina Lt., N. 50° E., 23.8 miles.	6000	...do.....	7.14 p. m.	47	crs. G., fne. G
H. 5696	Yaquina Lt., N. 53° E., 20.9 miles.	6000	...do.....	7.40 p. m.	44	Shl., rky., Co
H. 5697	Yaquina Lt., N. 57° E., 18.2 miles.	6000	...do.....	8.05 p. m.	43	fne. gy. S., crs. G., P.
H. 5698	Yaquina Lt., N. 62½° E., 15.5 miles.	6000	...do.....	8.31 p. m.	36	Shl., rky., Co., fne. G.
H. 5699	Yaquina Lt., N. 69½° E., 13.1 miles.	6000	...do.....	8.52 p. m.	47	crs. gy. S., For
H. 5700	Yaquina Lt., N. 53° E., 8.8 miles.	6000	Sept. 2	5.24 a. m.	39	.....do
H. 5701	Yaquina Lt., N. 57½° E., 11.6 miles.	6000	...do.....	5.49 a. m.	40	.....do
H. 5702	Yaquina Lt., N. 60° E., 14.5 miles.	6000	...do.....	6.14 a. m.	33	Shl., hrd. M
H. 5703	Yaquina Lt., N. 62° E., 17.4 miles.	6000	...do.....	6.39 a. m.	43	crs. gy. S
H. 5704	Yaquina Lt., N. 63° E., 20.2 miles.	6000	...do.....	7.04 a. m.	61	crs. G
H. 5705	Yaquina Lt., N. 63° E., 21.2 miles.	6000	...do.....	7.16 a. m.	67	Shl., rky., bk. S
H. 5706	Yaquina Lt., N. 63° E., 20.7 miles.	6000	...do.....	7.30 a. m.	63	crs. gy. S., fne. G., brk. Sh.
H. 5707	Yaquina Lt., N. 54° E., 19.7 miles.	6000	...do.....	10.57 a. m.	44	Shl., gran., crs. gy. S., fne. G.
H. 5708	Yaquina Lt., N. 51° E., 19.7 miles.	6000	...do.....	11.08 a. m.	40	Shl., gran., fne. gy. S., fne. G., crs. G.
H. 5709	Yaquina Lt., N. 48° E., 19.7 miles.	6000	...do.....	11.21 a. m.	42	fne. gy. S., fne. G
H. 5710	Yaquina Lt., N. 45° E., 19.8 miles.	6000	...do.....	11.33 a. m.	42	Shl., gran
H. 5711	Yaquina Lt., N. 42° E., 19.9 miles.	6000	...do.....	11.45 a. m.	42	fne. gy. S
H. 5712	Yaquina Lt., N. 39° E., 20 miles.	6000	...do.....	11.56 a. m.	42	.....do
H. 5713	Yaquina Lt., N. 53° E., 5.8 miles.	6000	...do.....	1.43 p. m.	29	crs. gy. S
H. 5714	Yaquina Lt., N. 62° E., 6.4 miles.	6000	...do.....	1.57 p. m.	33	.....do
H. 5715	Yaquina Lt., N. 77½° E., 8 miles.	6000	...do.....	3.00 p. m.	42	crs. gy. S., fne. G
H. 5716	Yaquina Lt., S. 84° E., 5.1 miles.	6000	...do.....	4.07 p. m.	34	crs. gy. S
H. 5717	Yaquina Lt., S. 80° E., 2.8 miles.	6000	...do.....	5.05 p. m.	28	.....do

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
60	54.0	......	......	......	Trn.-Blish sdr.; 32-lb. lead.	......	......	......	......	
....	.....	46.05	33.55	32.34	Tnr.-Blish sdr.; 32-lb. lead; Ek. bot.; 2 skates.	botm...	120	......	.....	F'wd dory out, 1.40; in, 4.31. Aft dory out, 1.39; in, 4.40. Fresh salmon bait.
....	.....	......	......	......	Tnr.-Blish sdr.; 32-lb. lead.	......	......	......	....	
....	.....	......	......	......	...do......	......	......	......	....	
58	53.0	......	......	......	Tnr.-Blish sdr.; 32-lb. lead.	......	......	......	....	
58	53.0	......	......	......	.....do......	......	......	......	....	
57	53.0	......	......	......	.....do......	......	......	......	....	
57	53.0	......	......	......	.....do......	......	......	......	....	
57	53.0	......	......	......	.....do......	......	......	......	....	
....	.....	......	......	......	.....do......	......	......	......	....	
....	.....	......	......	......	.....do......	......	......	......	....	
....	.....	......	......	......	.....do......	......	......	......	....	
51	48.0	......	......	......	.....do......	......	......	......	....	
52	48.0	......	......	......	.....do......	......	......	......	....	
53	48.0	......	......	......	.....do......	......	......	......	....	
53	48.0	......	......	......	.....do......	......	......	......	....	
52	48.0	......	......	......	.....do......	......	......	......	....	
52	49.0	......	......	......	.....do......	......	......	......	....	
52	*50.8	45.95	33.95	32.54	Tnr.-Blish sdr.; 32-lb. lead; Ek. bot.; 2 skates.	botm...	120	......	.....	F'wd dory out, 7.33; in, 10.22. Aft dory out, 7.33; in, 10.26. Temp. taken at 7.50 a. m.
57	49.0	......	......	......	Tnr.-Blish sdr.; 32-lb. lead.	......	......	......	....	
57	49.0	......	......	......	.....do......	......	......	......	....	
57	49.0	......	......	......	.....do......	......	......	......	....	
56	49.0	......	......	......	.....do......	......	......	......	....	
56	49.0	......	......	......	.....do......	......	......	......	....	
....	.....	......	......	......	.....do......	......	......	......	....	
....	.....	......	......	......	.....do......	......	......	......	....	
....	.....	......	......	......	Tnr.-Blish sdr.; 32-lb. lead; oys. dr.; 150-lb. sinker.	botm...	17½	S. 12° E...	1	Cable out 100 fms.
....	.....	......	......	......	Tnr.-Blish sdr.; 32-lb. lead; 9′ Ag.	...do....	19	S........	1	Cable out 120 fms.
57	54.0	......	......	......	Tnr.-Blish sdr.; 32-lb. lead; 9′ Ag.; 2 trimming wts.	...do....	17	S. 13° W..	1	Cable out 170 fms.
58	54.0	......	......	......	.....do......	...do....	15	S........	.7	Sheave at lower end of boom failed to turn at times. Cable out 100 fms.

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5718	Yaquina Lt., N. 75° E., 4 miles.	6000	Sept. 2	5.53 p. m.	33	crs. gy. S
H. 5719	Yaquina Lt., N. 84° E., 5.5 miles.	6000	Sept. 3	5.44 a. m.	....	med. gy. S
H. 5720	Yaquina Lt., N. 85° E., 6.5 miles.	6000	...do.....	6.06 a. m.	40	.....do
H. 5721	Yaquina Lt., N. 85½° E., 7.5 miles.	6000	...do.....	6.24 a. m.	38	.....do
H. 5722	Yaquina Lt., N. 86° E., 8.5 miles.	6000	...do.....	6.41 a. m.	42	.....do
H. 5723	Yaquina Lt., N. 86½° E., 9.5 miles.	6000	...do.....	6.59 a. m.	43	.....do
H. 5724	Yaquina Lt., N. 87° E., 10.5 miles.	6000	...do.....	7.18 a. m.	45	Shl., gran., fne. gy. S., For.
H. 5725	Yaquina Lt., S. 77° E., 8.7 miles.	6000	...do.....	7.59 a. m.	48	fne. gy. S
H. 5726	Yaquina Lt., S. 60½° E., 8 miles.	6000	...do.....	8.50 a. m.	....	.....do
H. 5727	Yaquina Lt., S. 43½° E., 10.8 miles.	6000	...do.....	9.25 a. m.	65	.....do
H. 5728	Yaquina Lt., S. 20½° E., 12.7 miles.	6000	...do.....	10.06 a. m.	53	.....do
H. 5729	Yaquina Lt., S. 8° E., 15 miles.	6000	...do.....	10.43 a. m.	35	.....do
H. 5730	Cape Kiwanda, N. 23½° E., 14.8 miles.	6000	...do.....	11.20 a. m.	43	.....do
H. 5731	Cape Kiwanda, N. 25½° E., 13.8 miles.	6000	...do.....	11.32 a. m.	45	.....do
H. 5732	Cape Kiwanda, N. 31° E., 12.2 miles.	6000	...do.....	11.51 a. m.	50	.....do
H. 5733	Cape Kiwanda, N. 22° E., 10.5 miles.	6000	...do.....	12.50 p. m.	32	.....do
H. 5734	Cape Kiwanda, N. 20½° E., 13.5 miles.	6000	...do.....	2.28 p. m.	30	crs. gy. S., crs. G., fne. G.
H. 5735	Cape Kiwanda, N. 34° E., 10.1 miles.	6000	...do.....	3.40 p. m.	42	crs. gy. S
H. 5736	Cape Kiwanda, N. 77° E., 8.7 miles.	6000	...do.....	5.03 p. m.	70	fne. gy. S
H. 5737	Cape Kiwanda, S. 70° E., 10 miles.	6000	...do.....	5.47 p. m.	77	.....do
H. 5738	Cape Meares Lt., N. 66° E., 4.8 miles.	6100	Sept. 4	5.12 a. m.	47	.....do
H. 5739	Cape Meares Lt., S. 86° E., 4 miles.	6100	...do.....	5.34 a. m.	43	.....do
H. 5740	Cape Meares Lt., S. 49½° E., 5.5 miles.	6100	...do.....	6.05 a. m.	44	.....do
H. 5741	Cape Meares Lt., S. 33° E., 7.8 miles.	6100	...do.....	6.24 a. m.	44	.....do
H. 5742	Cape Meares Lt., S. 28° E., 8.5 miles.	6100	...do.....	6.36 a. m.	43	.....do
H. 5743	Cape Meares Lt., S. 25° E., 9.4 miles.	6100	...do.....	6.47 a. m.	43	.....do
H. 5744	Cape Meares Lt., S. 15° E., 12 miles.	6100	...do.....	9.56 a. m.	38	.....do
H. 5745	Cape Meares Lt., S. 9° E., 14 miles.	6100	...do.....	10.15 a. m.	32	crs. gy. S
H. 5746	Cape Meares Lt., S. 12° E., 16.8 miles.	6100	...do.....	10.41 a. m.	40	fne. gy. S
H. 5747	Tillamook Lt., N. 17½° E., 8.1 miles.	6100	...do.....	11.08 a. m.	43	.....do

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
52	54.0				Tnr.-Blish sdr.; 32-lb. lead; oys. dr.; 2 trimming wts.; 150-lb. sinker.	botm	15⅓	S. 67° E.	1	Cable out 120 fms
52	51.0				Tnr.-Blish sdr.; 32-lb. lead.					
52	51.0				do					
52	51.0				do					
52	52.0				do					
52	52.0				do					
52	52.0				do					
					do					
					do					
					do					
					do					
					do					
					do					
58	53.0	45.9	32.57	31.33	Tnr.-Blish sdr.; 32-lb. lead; Ek. bot.; 2 skates.	botm	120			F'wd dory out, 11.32; in, 2.12. Aft dory out, 11.32; in, 2.08. Fresh salmon bait. Ek. bot. lowered at 1.40 to 75 fms.
58.5	53.0				Tnr.-Blish sdr.; 32-lb. lead; oys. dr.; 150-lb. sinker; 3 trimming wts.	do	20½	S. 26° E.	1	Cable out 200 fms. A small hole was torn in wire netting.
59	53.0				do	do	15	do	1	
57	53.0				do	do		do	1	
57	53.0				do	do		do	1	
59	53.0				Tnr.-Blish sdr.; 32-lb. lead.					
59	53.0				do					
					do					
					do					
					do					
					do					
					do					
58	*56.5	45.75	33.66	30.75	Tnr.-Blish sdr.; 32-lb. lead; Ek. bot.; 2 skates.	botm	120			F'wd dory out, 6.49; in, 9.30. Aft dory out, 6.49; in, 9.26. Temp. taken, 7.10 a. m. Fresh salmon bait.
58	54.0				Tnr.-Blish sdr.; 32-lb. lead.					
57	54.0				do					
57	54.0				do					
57	54.0				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1914.		*Fms.*	
H. 5748	Tillamook Lt., N. 23° E., 7.5 miles.	6100	Sept. 4	11.21 a. m.	48	fne. gy. S.
H. 5749	Tillamook Lt., N. 30° E., 7 miles.	6100	...do.....	11.38 a. m.	45	.....do.
H. 5750	Tillamook Lt., N. 36° E., 8.7 miles.	6100	...do.....	12.10 p. m.	54	.....do.
H. 5751	Tillamook Lt., N. 43½° E., 8.2 miles.	6100	...do.....	12.27 p. m.	56	.....do.
H. 5752	Tillamook Lt., N. 55½° E., 4.3 miles.	6100	...do.....	3.53 p. m.	44	.....do.
H. 5753	Tillamook Lt., S. 53° E., 2.9 miles.	6100	...do.....	4.31 p. m.	40	.....do.
H. 5754	Tillamook Lt., S. 35° E., 6.6 miles.	6100	...do.....	5.07 p. m.	42	.....do.
H. 5755	Tillamook Lt., S. 28° E., 10.5 miles.	6100	...do.....	5.43 p. m.	41	
H. 5756	North Head Lt., N. 21° E., 9.4 miles.	6100	...do.....	6.10 p. m.	36	fne. gy. S.
H. 5757	Cape Shoalwater Lt., S. 83° E., 7.9 miles.	6100	Sept. 5	7.11 a. m.	27	fne. gy. S., gn. M.
H. 5758	Cape Shoalwater Lt., S. 83° E., 10.8 miles.	6100	...do.....	7.35 a. m.	36	fne. gy. S.
H. 5759	Cape Shoalwater Lt., S. 83° E., 13.8 miles.	6100	...do.....	8.00 a. m.	44	.....do.
H. 5760	Cape Shoalwater Lt., S. 82° E., 16.7 miles.	6100	...do.....	8.25 a. m.	46	
H. 5761	Cape Shoalwater Lt., S. 82° E., 19 miles.	6100	...do.....	8.42 a. m.	57	gn. M.
H. 5762	Cape Shoalwater Lt., S. 81° E., 21.1 miles.	6100	...do.....	9.00 a. m.	63	.....do.
H. 5763	Cape Shoalwater Lt., S. 81° E., 22.2 miles.	6100	...do.....	9.11 a. m.	67	.....do.
H. 5764	Cape Shoalwater Lt., S. 80° E., 23.2 miles.	6100	...do.....	9.24 a. m.	71	.....do.
H. 5765	Cape Shoalwater Lt., S. 75° E., 23 miles.	6100	...do.....	9.45 a. m.	65	.....do.
H. 5766	Cape Shoalwater Lt., S. 70° E., 22.9 miles.	6100	...do.....	10.02 a. m.	60	.....do.
H. 5767	Cape Shoalwater Lt., S. 65½° E., 21.9 miles.	6100	...do.....	10.20 a. m.	55	.....do.
H. 5768	Cape Shoalwater Lt., S. 60½° E., 21 miles.	6100	...do.....	10.37 a. m.	50	.....do.
H. 5769	Cape Shoalwater Lt., S. 55½° E., 20.5 miles.	6100	...do.....	10.54 a. m.	44	
H. 5770	Cape Shoalwater Lt., S. 50° E., 20.8 miles.	6100	...do.....	11.13 a. m.	40	crs. G., fne. G., gy., S.
H. 5771	Cape Shoalwater Lt., S. 49° E., 20.9 miles.	6100	...do.....	11.20 a. m.	38	fne. G., crs. S.
H. 5772	Cape Shoalwater Lt., S. 57½° E., 34 miles.	6100	...do.....	1.03 p. m.	69	gn. M.
H. 5773	Cape Shoalwater Lt., S. 57° E., 35 miles.	6100	...do.....	1.15 p. m.	73	Shl., gran.
H. 5774	Cape Shoalwater Lt., S. 56½° E., 36 miles.	6100	...do.....	1.26 p. m.	74	gn. M.
H. 5775	North Head, N. 56° E., 12.6 miles.	6100	1915. July 9	7.35 a. m.	60	
H. 5776	North Head, N. 67° E., 13.1 miles.	6100	...do.....	7.57 a. m.	68	fne. gn. S.
H. 5777	North Head, N. 78° E., 14.2 miles.	6100	...do.....	8.18 a. m.	140	
H. 5778	North Head, N. 86½° E., 15.5 miles.	6100	...do.....	8.43 a. m.	96	fne. gn. S.
H. 5779	North Head, N. 89½° E., 16.2 miles.	6100	...do.....	8.53 a. m.	77	fne. bk. S.
H. 5780	North Head, S. 88° E., 16.8 miles.	6100	...do.....	9.02 a. m.	74	fne. gy. S.
H. 5781	North Head, S. 85° E., 17.8 miles.	6100	...do.....	9.12 a. m.	74	.....do.

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
57	54.0				Tnr.-Blish sdr.: 32-lb. lead.					
57	54.0				do					
56	51.0				do					
57	54.0				Tnr.-Blish sdr.; 32-lb. lead; 2 skates.	botm	120			F'wd dory out, 12.30; in, 3.12. Aft dory out, 12.30; in, 3.09.
57	55.0				Tnr.-Blish sdr.; 32-lb. lead.					
					do					
					do					
					do					Lead was lost by wire breaking while heaving in.
					do					
56	51.0				do					
56	51.0				do					
56	51.0				do					
56	51.0				do					
56	51.0				do					
60	53.0				do					
60	53.0				do					
60	53.0				do					
60	53.0				do					
60	53.0				do					
60	53.0				do					
60	53.0				do					
62	53.0				do					
62	53.0				do					
62 62	53.0 *56.1	45.35	33.24	32.47	Tnr.-Blish sdr.; 32-lb. lead; Ek. bot.; 4 skates.	botm				F'wd dory out, 11.28; in, 3.10. Aft dory out, 11.24; in, 3.12. Temp. taken at 11.10 a. m. and 3.18 p. m. Fresh salmon bait.
					Tnr.-Blish sdr.; 32-lb. lead.					
					do					
					do					
60	54				El. sdr.; 30-lb. lead.					Lead lost.
62	54				do					
61	54				do					Clean lead.
64	54				do					Do.
65	54				do					
66	55				do					
66	55				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 5782	North Head, S. 82° E., 18.7 miles.	6100	July 9	9.22 a. m.	76	fne. gy. S.
H. 5783	North Head, S. 80° E., 19.4 miles.	6100	do	9.33 a. m.	77	
H. 5784	North Head, S. 78° E., 20.2 miles.	6100	do	9.43 a. m.	81	fne. gy. S.
H. 5785	North Head, S. 76½° E., 21 miles.	6100	do	9.52 a. m.	85	do
H. 5886	North Head, S. 75° E., 21.7 miles.	6100	do	10.03 a. m.	135	do
H. 5787	North Head, S. 72° E., 20.5 miles.	6100	do	10.20 a. m.	88	do
H. 5788	North Head, S. 71¾° E., 18.8 miles.	6100	do	10.29 a. m.	87	do
H. 5789	North Head, S. 71½° E., 17.4 miles.	6100	do	10.38 a. m.	85	do
H. 5790	North Head, S. 71° E., 14.2 miles.	6100	do	11.03 a. m.	69	gn. M., fne. gy. S.
H. 5791	North Head, S. 70° E., 11.5 miles.	6100	do	11.32 a. m.	50	do
H. 5792	North Head, N. 84° E., 13.6 miles.	6100	do	12.30 p. m.	217	fne. gy. S.
H. 5793	North Head, N. 82° E., 14.3 miles.	6100	do	12.42 p. m.	218	fne. bk. S.
H. 5794	North Head, N. 79° E., 15.3 miles.	6100	do	12.53 p. m.	241	hrd
H. 5795	North Head, N. 80° E., 16.2 miles.	6100	do	1.16 p. m.	248	fne. gy. s., gn. M.
H. 5796	North Head, N. 85° E., 17.6 miles.	6100	do	1.39 p. m.	111	fne. gy. S.
H. 5797	North Head, N. 88° E., 18.2 miles.	6100	do	1.50 p. m.	78	fne. gy. S., gn. M., bk. Sp.
H. 5798	North Head, N. 87½° E., 19.2 miles.	6100	do	2.01 p. m.	81	fne. gy. S., bk. Sp.
H. 5799	North Head, N. 87° E., 20.2 miles.	6100	do	2.13 p. m.	77	fne. gy. S.
H. 5800	North Head, N. 86½° E., 21 miles.	6100	do	2.23 p. m.	79	bk. S.
H. 5801	North Head, N. 86° E., 22 miles.	6100	do	2.33 p. m.	83	do
H. 5802	North Head, N. 86° E., 23 miles.	6100	do	2.44 p. m.	204	bl. M.
H. 5803	North Head, S. 88° E., 22.1 miles.	6100	do	3.13 p. m.	84	fne. bk. S.
H. 5804	North Head, S. 80° E., 21.5 miles.	6100	do	3.39 p. m.	82	fne. bk. S., Sh. (1).
H. 5805	North Head, S. 66½° E., 22.6 miles.	6100	do	4.27 p. m.	$\frac{0}{295}$	
H. 5806	North Head, S. 53½° E., 25 miles.	6100	do	5.12 p. m.	$\frac{0}{295}$	
H. 5807	Grays Harbor Lt., S. 67° E., 17 miles.	6400	July 20	8.23 a. m.	46	crs. G.
H. 5808	Grays Harbor Lt., S. 67½° E., 19 miles.	6400	do	8.41 a. m.	49	G.
H. 5809	Grays Harbor Lt., S. 67½° E., 21 miles.	6400	do	8.58 a. m.	53	fne. gy. S.
H. 5810	Grays Harbor Lt., S. 67½° E., 23 miles.	6400	do	9.16 a. m.	65	fne. bk. S., Mi.
H. 5811	Grays Harbor Lt., S. 68° E., 25 miles.	6400	do	9.34 a. m.	64	fne. gy S., Mi., M.
H. 5812	Grays Harbor Lt., S. 68° E., 27 miles.	6400	do	9.52 a. m.	68	do
H. 5813	Grays Harbor Lt., S. 68° E., 29 miles.	6400	do	10.10 a. m.	73	fne. gy. S., Mi.
H. 5814	Grays Harbor Lt., S. 68° E., 31 miles.	6400	do	10.28 a. m.	80	fne. gy. S., Mi., M.
H. 5815	Grays Harbor Lt., S. 68° E., 33 miles.	6400	do	10.46 a. m.	84	
H. 5816	Grays Harbor Lt., S. 68½° E., 35 miles.	6400	do	11.07 a. m.	87	fne. gy. S.
H. 5817	Grays Harbor Lt., S. 68½° E., 36.2 miles.	6400	do	11.18 a. m.	92	do
H. 5818	Grays Harbor Lt., S. 68½° E., 37.2 miles.	6400	do	11.30 a. m.	104	crs. & fne. bk. S.

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
65	55				El. sdr.; 30-lb. lead.					
65	55				do					Arming lost.
65	55				do					
64	55				do					
64	55				do					
65	55				do					
65	56				do					
65	56				do					
65	56				do					
66	56				do					
66	56				do					
65	56				do					
66	56				do					
65	56				do					
64	56				do					
65	56				do					
....	56				do					
66	56				do					
65	56				do					
65	56				do					
66	56				do					
69	56				do					
68	56				do					
69	56				do					Sounding wire was only 295 fms. long; wire all let out, but no botm.
68	56				do					Do.
62	52				El. sdr.; 35-lb. lead.					
62	52				do					
62	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					Lead lost.
61	52				do					
61	52				do					
61	52				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 5819	Grays Harbor Lt., S. 68½° E., 38.2 miles.	6400	July 20	11.42 a. m.	194	fne. gy. S., Mi......
H. 5820	Grays Harbor Lt., S. 67½° E., 35 miles.	6400	...do.....	12.14 p. m.	90	fne. gy. S..........
H. 5821	Grays Harbor Lt., S. 67° E., 33 miles.	6400	...do.....	12.33 p. m.	82	....
H. 5822	Grays Harbor Lt., S. 66° E., 31 miles.	6400	...do.....	12.53 p. m.	76	gn. M..............
H. 5823	Grays Harbor Lt., S. 65½° E., 29.2 miles.	6400	...do.....	1.12 p. m.	68	gn. M., fne. gy. S...
H. 5824	Grays Harbor Lt., S. 64° E., 27.2 miles.	6400	...do.....	1.32 p. m.	65	.....do............
H. 5825	Grays Harbor Lt., S. 64½° E., 30.2 miles.	6400	...do.....	2.04 p. m.	75	gn. M..............
H. 5826	Grays Harbor Lt., S. 65° E., 32.2 miles.	6400	...do.....	2.24 p. m.	81	.....do............
H. 5827	Grays Harbor Lt., S. 65° E., 34.2 miles.	6400	...do.....	2.42 p. m.	83	.....do............
H. 5828	Grays Harbor Lt., S. 65° E., 36.2 miles.	6400	...do.....	3.02 p. m.	88	fne. gy. S., gn. M...
H. 5829	Grays Harbor Lt., S. 65½° E., 37.4 miles.	6400	...do.....	3.10 p. m.	92	crs. & fne. gy. S....
H. 5830	Grays Harbor Lt., S. 65½° E., 38.4 miles.	6400	...do.....	2.54 p. m.	95	....
H. 5831	Grays Harbor Lt., S. 65½° E., 39.5 miles.	6400	...do.....	3.05 p. m.	110	....
H. 5832	Grays Harbor Lt., S. 65½° E., 40.5 miles.	6400	...do.....	3.16 p. m.	$\frac{0}{295}$	....
H. 5833	Grays Harbor Lt., S. 64½° E., 38.5 miles.	6400	...do.....	3.45 p. m.	93	fne. gy. S., gn. M., Sh.
H. 5834	Grays Harbor Lt., S. 63½° E., 36.5 miles.	6400	...do.....	4.06 p. m.	84	fne. gy. S., gn. M...
H. 5835	Grays Harbor Lt., S. 62½° E., 34.5 miles.	6400	...do.....	4.25 p. m.	80	.....do............
H. 5836	Grays Harbor Lt., S. 61° E., 32.7 miles.	6400	...do.....	4.43 p. m.	74	....
H. 5837	Grays Harbor Lt., S. 59½° E., 30 miles.	6400	...do.....	5.00 p. m.	69	fne. gy. S., gn. M...
H. 5838	Grays Harbor Lt., S. 57½° E., 29.2 miles.	6400	...do.....	5.18 p. m.	64	fne. gy. S..........
H. 5839	Grays Harbor Lt., S. 55½° E., 27.2 miles.	6400	...do.....	5.38 p. m.	56	.....do............
H. 5840	Grays Harbor Lt., S. 53½° E., 25.5 miles.	6400	...do.....	5.56 p. m.	49	.....do............
H. 5841	Grays Harbor Lt., S. 50½° E., 23.8 miles.	6400	...do.....	6.16 p. m.	48	.....do............
H. 5842	Grays Harbor Lt., S. 48° E., 22.2 miles.	6400	...do.....	6.35 p. m.	38	crs. bk. S..........
H. 5843	Grays Harbor Lt., S. 44° E., 20.5 miles.	6400	...do.....	6.55 p. m.	37	fne. gy. S..........
H. 5844	Grays Harbor Lt., S. 40° E., 19 miles.	6400	...do.....	7.07 p. m.	29	fne. rd. & gy. S....
H. 5845	Destruction Id. Lt., N. 28° E., 20.2 miles.	6400	July 21	7.06 a. m.	63	gn. M., fne. gy. S..
H. 5846	Destruction Id. Lt., N. 31½° E., 21 miles.	6400	...do.....	7.24 a. m.	75	gn. M..............
H. 5847	Destruction Id. Lt., N. 36° E., 22.3 miles.	6400	...do.....	7.43 a. m.	249	....
H. 5848	Destruction Id. Lt., N. 37° E., 21.5 miles.	6400	...do.....	8.00 a. m.	290	gn. M..............
H. 5849	Destruction Id. Lt., N. 40° E., 19.8 miles.	6400	...do.....	8.22 a. m.	80	gn. M., fne. gy. S..
H. 5850	Destruction Id. Lt., N. 41½° E., 19 miles.	6400	...do.....	8.32 a. m.	70	.....do............
H. 5851	Destruction Id. Lt., N. 43½° E., 18.2 miles.	6400	...do.....	8.47 a. m.	74	gn. M..............
H. 5852	Destruction Id. Lt., N. 45½° E., 17.6 miles.	6400	...do.....	8.59 a. m.	70	gn. M., fne. gy. S..
H. 5853	Destruction Id. Lt., N. 47½° E., 18.3 miles.	6400	...do.....	9.14 a. m.	76	.....do............
H. 5854	Destruction Id. Lt., N. 49½° E., 19.1 miles.	6400	...do.....	9.24 a. m.	95	.....do............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
61	52				El. sdr.; 35-lb. lead.					
62	53				do					
62.5	53				do					
62	53				do					
62.5	54				El. sdr.; 30-lb. lead.					
64	54				do					
64	54				do					
64	54				do					
64	54				do					At 2.30 p. m. set clock back 26 min,, which is not shown on records of H. 5827 and H. 5829 incl. H. 5830 shows correct time.
64	54				do					
65	54				do					
65	54				do					Arming lost.
64	54				do					Do.
63	54				do					
62	54				do					
62	54				do					
62	54				do					
62	54				do					
63	54				do					
63	54				do					
62	54				do					
63	54				do					
63	54				do					
63	54				do					
62	54				do					
61	53				do					
60	52				do					
60	52				do					
60	52				do					Clean lead
60	52				do					
60	52				do					
60	52				do					
60	52				do					
60	53				do					
60	53				do					
60	53				do					

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 5855	Destruction Id. Lt., N. 51½° E., 19.8 miles.	6400	July 21	9.35 a. m.	241	gn. M., fne. gy. S..
H. 5856	Destruction Id. Lt., N. 53° E., 20.8 miles.	6400	...do.....	9.51 a. m.	$\frac{0}{287}$	....
H. 5857	Destruction Id. Lt., N. 55½° E., 20.1 miles.	6400	...do.....	10.09 a. m.	$\frac{0}{298}$	....
H. 5858	Destruction Id. Lt., N. 58° E., 19.6 miles.	6400	...do.....	10.25 a. m.	246	....
H. 5859	Destruction Id. Lt., N. 60° E., 19.1 miles.	6400	...do.....	10.40 a. m. to 12.00 m.	88	G., crs. bk. S......
H. 5860	Destruction Id. Lt., N. 63° E., 18.7 miles.	6400	...do.....	1.25 p. m.	92	gn. M., fne. gy. S..
H. 5861	Destruction Id. Lt., N. 66° E., 18.2 miles.	6400	...do.....	1.37 p. m.	87	.....do............
H. 5862	Destruction Id. Lt., N. 68° E., 18 miles.	6400	...do.....	1.49 p. m.	78	gn. M.............
H. 5863	Destruction Id. Lt., N. 69° E., 18.9 miles.	6400	...do.....	2.02 p. m.	84	gn. M., fne. gy. S..
H. 5864	Destruction Id. Lt., N. 70° E., 19.8 miles.	6400	...do.....	2.12 p. m.	95	gn. M., bk. S......
H. 5865	Destruction Id. Lt., N. 70½° E., 20.9 miles.	6400	...do.....	2.23 p. m.	100	.....do............
H. 5866	Destruction Id. Lt., N. 71° E., 21.8 miles.	6400	...do.....	2.34 p. m.	103	G., fne. gy. S., crs. bk. S.
H. 5867	Destruction Id. Lt., N. 71½° E., 22.8 miles.	6400	...do.....	2.45 p. m.	189	fne. gy. S..........
H. 5868	Destruction Id. Lt., N. 73½° E., 22 miles.	6400	...do.....	3.03 p. m.	105	fne. G., gy. S......
H. 5869	Destruction Id. Lt., N. 75° E., 21.3 miles.	6400	...do.....	3.15 p. m.	101	gn. M., fne. G., Sh., fne. gy. S.
H. 5870	Destruction Id. Lt., N. 76½° E., 20.5 miles.	6400	...do.....	3.26 p. m.	93	fne. G., gn. M., fne. bk. S.
H. 5871	Destruction Id. Lt., N. 70½° E., 18.2 miles.	6400	July 22	4.47 a. m.	76	gn. M.............
H. 5872	Destruction Id. Lt., N. 71° E., 20.3 miles.	6400	...do.....	5.04 a. m.	93	....
H. 5873	Destruction Id. Lt., N. 71° E., 21.2 miles.	6400	...do.....	5.16 a. m.	103	gn. M.............
H. 5874	Destruction Id. Lt., N. 71° E., 21.8 miles.	6400	...do.....	5.25 a. m.	105	fne. gy. S., gn. M..
H. 5875	Destruction Id. Lt., N. 72½° E., 22 miles.	6400	...do.....	5.36 a. m.	105	G., gn. M., fne. gy. S.
H. 5876	Destruction Id. Lt., N. 74° E., 22 miles.	6400	...do.....	5.48 a. m.	103	crs. G.............
H. 5877	Destruction Id. Lt., N. 75° E., 21.8 miles.	6400	...do.....	6.02 a. m.	101	G., gn. M., fne. gy. S.
H. 5878	Destruction Id. Lt., N. 79° E., 19.9 miles.	6400	...do.....	9.38 a. m.	99	gn. M., crs. G., fne. bk. S.
H. 5879	Destruction Id. Lt., N. 81° E., 20.6 miles.	6400	...do.....	9.51 a. m.	97	gn. M., fne. gy. S..
H. 5880	Destruction Id. Lt., N. 82½° E., 20.2 miles.	6400	...do.....	10.01 a. m.	93	....
H. 5881	Destruction Id. Lt., N. 87° E., 19.8 miles.	6400	...do.....	10.20 a. m.	84	gn. M.............
H. 5882	Destruction Id. Lt., N. 87° E., 20.8 miles.	6400	...do.....	10.34 a. m.	97	.....do............
H. 5883	Destruction Id. Lt., N. 87° E., 21.8 miles.	6400	...do.....	10.45 a. m.	97	gn. M., fne. gy. S..
H. 5884	Destruction Id Lt., N. 87° E., 22.8 miles.	6400	...do.....	10.58 a. m.	101	fne. bk. S.........
H. 5885	Destruction Id. Lt., N. 87° E., 23.9 miles.	6400	...do.....	11.09 a. m.	104	.....do............
H. 5886	Destruction Id. Lt., N. 87° E., 24.9 miles.	6400	...do.....	11.20 a. m.	235	.....do............
H. 5887	Destruction Id. Lt., N. 88½° E., 24.1 miles.	6400	...do.....	11.40 a. m.	160	.....do............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
60	53	......	......	......	El. sdr.; 30-lb. lead.	....	......	....	....	
60	53	......	......	......	.....do........	....	......	....	....	
61	53	......	......	......	.....do........	....	......	....	....	
61	53	......	......	......	.....do........	....	......	....	....	
62	*57.5	44.95	32.23	32.66	El. sdr.; 30-lb. lead; Ek. bot.; NZ; 2 skates.	botm...	60	....	....	1st dory left 10.46; 1st dory ret. 12.52; 2d dory left 10.48; 2d dory ret. 1.06. Frozen herring bait.
61	53	......	......	......	El. sdr.; 30-lb. lead.	....	......	....	....	
61	53	......	......	......	.....do........	....	......	....	....	
61	54	......	......	......	.....do........	....	......	....	....	
61	54	......	......	......	.....do........	....	......	....	....	
61	54	......	......	......	.....do........	....	......	....	....	
61	54	......	......	......	.....do........	....	......	....	....	
61	54	......	......	......	.....do........	....	......	....	....	
61	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
52	57	......	......	......	.....do........	....	......	....	....	
59	52	......	......	......	.....do........	....	......	....	....	Clean lead.
59	52	......	......	......	.....do........	....	......	....	....	
59	52	......	......	......	.....do........	....	......	....	....	This station is the same as H. 5866.
59	52	......	......	......	.....do........	....	......	....	....	
....	.....	......	......	......	.....do........	....	......	....	....	
59	*56	44.35	32.45	34.05	El. sdr.; 30-lb. lead; Ek. bot.; 4′ inter.; #12, #20; NZ.	botm...	60	....	....	1st dory left 6.10; 1st dory ret. 9.00. 2d dory left 6.15; 2d dory ret. 9.17. Frozen herring bait. Vertical townet haul.
64	54	......	......	......	El. sdr.; 30-lb. lead.	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
65	54	......	......	......	.....do........	....	......	....	....	
65	54	......	......	......	.....do........	....	......	....	....	
65	54	......	......	......	.....do........	....	......	....	....	
65	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	
64	54	......	......	......	.....do........	....	......	....	....	

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 5888	Destruction Id. Lt., S. 89½° E., 23.1 miles.	6400	July 22	11.52 a. m.	116	fne. bk. S., G......
H. 5889	Destruction Id. Lt., S. 89° E., 22.3 miles.	6400	...do.....	12.03 p. m.	94	fne. bk. S., gn. M..
H. 5890	Destruction Id. Lt., S. 87½° E., 21.3 miles.	6400	...do.....	12.15 p. m.	90	fne. gy. S., gn. M..
H. 5891	Destruction Id. Lt., S. 86° E., 20.5 miles.	6400	...do.....	12.27 p. m.	92	.....do............
H. 5892	Destruction Id. Lt., S. 85° E., 19.6 miles.	6400	...do.....	12.39 p. m.	80	gn. M., fne. gy. S., bk. Sp.
H. 5893	Destruction Id. Lt., S. 83° E., 20.2 miles.	6400	...do.....	12.53 p. m.	78	gn. M.............
H. 5894	Destruction Id. Lt., S. 80° E., 20.3 miles.	6400	...do.....	1.05 p. m.	85	.....do............
H. 5895	Destruction Id. Lt., S. 78½° E., 21 miles.	6400	...do.....	1.16 p. m.	86	.....do............
H. 5896	Destruction Id. Lt., S. 77° E., 21.9 miles.	6400	...do.....	1.27 p. m.	80	gn. M., bk. S......
H. 5897	Destruction Id. Lt., S. 75° E., 22.7 miles.	6400	...do.....	3.05 p. m.	88	fne. gy. S., gn. M..
H. 5898	Destruction Id. Lt., S. 74° E., 23.3 miles.	6400	...do.....	3.24 p. m.	111	gn. M.............
H. 5899	Destruction Id. Lt., S. 72½° E., 24.3 miles.	6400	...do.....	3.37 p. m.	96	gn. M., fne. gy. S..
H. 5900	Destruction Id. Lt., S. 71½° E., 25.1 miles.	6400	...do.....	3.48 p. m.	100	gn. M.............
H. 5901	Destruction Id. Lt., S. 70° E., 25.9 miles.	6400	...do.....	4.00 p. m.	92	.....do............
H. 5902	Destruction Id. Lt., S. 69½° E., 26.7 miles.	6400	...do.....	4.11 p. m.	97	.....do............
H. 5903	Destruction Id. Lt., S. 68½° E., 27.6 miles.	6400	...do.....	4.24 p. m.	93	gn. M., fne. gy. S..
H. 5904	Destruction Id. Lt., S. 67½° E., 28.4 miles.	6400	...do.....	4.35 p. m.	93	.....do............
H. 5905	Destruction Id. Lt., S. 66½° E., 29.3 miles.	6400	...do.....	4.48 p. m.	93	gn. M.............
H. 5906	Destruction Id. Lt., S. 65½° E., 30.1 miles.	6400	...do.....	5.00 p. m.	94	gn. M., fne. gy. S..
H. 5907	Destruction Id. Lt., S. 65° E., 31 miles.	6400	...do.....	5.14 p. m.	94	....
H. 5908	Destruction Id. Lt., S. 64° E., 31.8 miles.	6400	...do.....	5.25 p. m.	94	gn. M.............
H. 5909	Destruction Id. Lt., S. 63½° E., 32.8 miles.	6400	...do.....	5.36 p. m.	95	gn. M., fne. gy. S., bk. Sp.
H. 5910	Destruction Id. Lt., S. 63° E., 33.7 miles.	6400	...do.....	5.49 p. m.	94	gn. M., bk. S......
H. 5911	Destruction Id. Lt., S. 62½° E., 34.6 miles.	6400	...do.....	6.01 p. m.	93	G., crs. bk. S., fne. gn. S., gn. M.
H. 5912	Destruction Id. Lt., S. 62° E., 35.5 miles.	6400	...do.....	6.15 p. m.	92	G., crs. and fne. bk. S.
H. 5913	Destruction Id. Lt., S. 61° E., 36.5 miles.	6400	...do.....	6.27 p. m.	90	fne. G., gy. S......
H. 5914	Destruction Id. Lt., S. 60½° E., 37.3 miles.	6400	...do.....	6.40 p. m.	92	bk. Sp., gn. M., fne. G., fne. gy. S.
H. 5915	Destruction Id. Lt., S. 60° E., 38.2 miles.	6400	...do.....	6.53 p. m.	88	G., crs. and fne. gy. S., gn. M.
H. 5916	Grays Harbor Lt., N. 76° E., 26.8 miles.	6400	July 23	4.36 p. m.	78	gn. M., fne. gy. S...
H. 5917	Grays Harbor Lt., N. 76⅓° E., 27.8 miles.	6400	...do.....	4.47 p. m.	82	gn. M., fne. gy. S., Mi.
H. 5918	Grays Harbor Lt., N. 76⅔° E., 28.8 miles.	6400	...do.....	4.58 p. m.	87	bl. C., fne. gy. S....
H. 5919	Grays Harbor Lt., N. 77° E., 29.8 miles.	6400	...do.....	5.10 p. m.	93	....
H. 5920	Grays Harbor Lt., N. 77⅓° E., 30.8 miles.	6400	...do.....	5.18 p. m.	99	crs. G., crs. bk. S., fne. gn. S., gran. Shl.
H. 5921	Grays Harbor Lt., N. 77⅔° E., 31.8 miles.	6400	...do.....	5.30 p. m.	111	fne. gn. S., fne. G..
H. 5922	Grays Harbor Lt., N. 78° E., 32.8 miles.	6400	...do.....	5.42 p. m.	203	fne. S.............
H. 5923	Grays Harbor Lt., N. 80° E., 31.8 miles.	6400	...do.....	5.58 p. m.	124	fne. gn. S., crs. bk. S., Mi.
H. 5924	Grays Harbor Lt., N. 82½° E., 30.7 miles.	6400	...do.....	6.10 p. m.	99	G., gran. Shl., crs. bk. S., fne. gy. S.

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
64	54				El. sdr; 30-lb. lead.					
65	55				do.					
65	55				do.					
65	55				do.					
65	55				do.					
60	55				do.					
60	55				do.					
60	55				do.					
60	55				do.					
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62	55				do.					
62	55				do.					
61	55				do.					
61	51				do.					
60	51				do.					
60	51				do.					
61	51				do.					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 5925	Grays Harbor Lt., N. 84° E., 30.2 miles.	6400	July 23	6.22 p. m.	95	fne. gy. S., gn. M., gran. Shl.
H. 5926	Grays Harbor Lt., N. 85° E., 29.7 miles.	6400	...do.....	6.36 p. m.	91	fne. gy. S., gn. M..
H. 5927	Grays Harbor Lt., N. 86° E., 29.2 miles.	6400	...do.....	6.50 p. m.	88	gn. M.............
H. 5928	Grays Harbor Lt., N. 87° E., 30 miles.	6400	...do.....	7.03 p. m.	90	fne. gy. S., gn. M., Mi.
H. 5929	Grays Harbor Lt., N. 88° E., 30.9 miles.	6400	...do.....	7.15 p. m.	90	bl. Shl.............
H. 5930	Grays Harbor Lt., N. 89° E., 31.9 miles.	6400	...do.....	7.28 p. m.	94	bl. Shl., fne. bk. S..
H. 5931	Grays Harbor Lt., E., 32.9 miles.	6400	...do.....	7.40 p. m.	111	fne. gy. S..........
H. 5932	Grays Harbor Lt., S. 89° E., 33.7 miles.	6400	...do.....	7.52 p. m.	279	bl. Shl., rky.......
H. 5933	Grays Harbor Lt., N. 84° E., 28.7 miles.	6400	July 24	8.31 a. m.	88	fne. gy. S., gn. M...
H. 5934	Grays Harbor Lt., N. 83° E., 29.8 miles.	6400	...do.....	8.48 a. m.	93	fne. gy. S..........
H. 5935	Grays Harbor Lt., N. 82⅔° E., 30.2 miles.	6400	...do.....	8.51 a. m.	98	.....do.............
H. 5936	Grays Harbor Lt., N. 82⅓° E., 30.6 miles.	6400	...do.....	8.59 a. m.	99	bl. M...............
H. 5937	Grays Harbor Lt., N. 82° E., 31.1 miles.	6400	...do.....	9.07 a. m.	111	crs. & fne. gn. S....
H. 5938	Grays Harbor Lt., N. 82⅔° E., 31 miles.	6400	...do.....	9.20 a. m.	107	fne. gn. S..........
H. 5939	Grays Harbor Lt., N. 83⅓° E., 31 miles.	6400	...do.....	9.29 a. m.	100	fne. gn. S., gran. Shl.
H. 5940	Grays Harbor Lt., N. 84° E., 31 miles.	6400	...do.....	9.34 a. m.	98	fne. gn. S..........
H. 5941	Grays Harbor Lt., S. 87° E., 31.3 miles.	6400	...do.....	1.54 p. m.	$\frac{0}{230}$	....
H. 5942	Grays Harbor Lt., S. 85° E., 31.5 miles.	6400	...do.....	2.07 p. m.	93	gn. M., fne. gn. S...
H. 5943	Grays Harbor Lt., S. 83° E., 31.9 miles.	6400	...do.....	2.20 p. m.	93	....
H. 5944	Grays Harbor Lt., S. 81½° E., 32.5 miles.	6400	...do.....	2.31 p. m.	93	gn. M., fne. gy. S...
H. 5945	Grays Harbor Lt., S. 80° E., 33 miles.	6400	...do.....	2.43 p. m.	93	fne. G., fne. gy. S...
H. 5946	Grays Harbor Lt., S. 78½° E., 33.8 miles.	6400	...do.....	2.58 p. m.	91	bl. Shl., crs. bk. S., fne. gn. S.
H. 5947	Grays Harbor Lt., S. 77° E., 34.3 miles.	6400	...do.....	3.08 p. m.	86	G., bl. M., crs. bk. S., fne. gy. S.
H. 5948	Grays Harbor Lt., S. 76° E., 35.2 miles.	6400	...do.....	3.21 p. m.	88	Co., gn. M., fne. gy. S.
H. 5949	Grays Harbor Lt., S. 75½° E., 36.2 miles.	6400	...do.....	3.34 p. m.	96	Co., hrd. bl. M....
H. 5950	Grays Harbor Lt., S. 74½° E., 37 miles.	6400	...do.....	3.46 p. m.	147	G., fne. gy. S., crs. bk. S., gran. Shl.
H. 5951	Grays Harbor Lt., S. 73° E., 36.9 miles.	6400	...do.....	4.04 p. m.	$\frac{0}{246}$	....
H. 5952	Grays Harbor Lt., S. 71½° E., 36.9 miles.	6400	...do.....	4.21 p. m.	$\frac{0}{242}$	....
H. 5953	Grays Harbor Lt., S. 70½° E., 36 miles.	6400	...do.....	4.38 p. m.	126	fne. gy. S.........
H. 5954	Grays Harbor Lt., S. 69½° E., 35.3 miles.	6400	...do.....	4.52 p. m.	90	G., Sh., fne. gy. S., gn. M.
H. 5955	Grays Harbor Lt., S. 68° E., 36 miles.	6400	...do.....	5.07 p. m.	88	fne. gy. S.........
H. 5956	Grays Harbor Lt., S. 67° E., 36.5 miles.	6400	...do.....	5.20 p. m.	87	.....do............
H. 5957	Grays Harbor Lt., S. 66¼° E., 37.4 miles.	6400	...do.....	5.35 p. m.	91	fne. and crs. gy. S..
H. 5958	Grays Harbor Lt., S. 65½° E., 38.2 miles.	6400	...do.....	5.48 p. m.	98	fne. gy. S.........
H. 5959	Grays Harbor Lt., S. 64¾° E., 39.1 miles.	6400	...do.....	6.00 p. m.	105	G., crs. and fne. gy. S.

Investigations off Oregon-Washington Coasts, 1914 and 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
61	51				El. sdr.; 30-lb. lead.					
57	53				do.					
61	53				do.					
60	53				do.					
60	53				do.					
60	53				do.					
60	53				do.					
60	53				do.					
61	52				do.					
61	52				do.					
61	52				do.					
60	52				do.					
60	52				do.					
60	52				do.					
60	52				do.					
60	*57.7	44.0	32.75	32.72	El. sdr.; 30-lb. lead; Ek. bot.; 4′ inter.; #12, #20; NZ; 2 skates.	botm...	60			Vertical townet haul: 1st dory left, 9.45; 1st dory ret., 12.58; 2d dory left, 9.50; 2d dory ret., 12.47. Vertical haul to 93 fms. Frozen herring bait.
63	53				El. sdr.; 30-lb. lead.					
63	52				do.					
63	53				do.					
63	53				do.					
63	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
62	53				do.					
63	52				do.					
63	52				do.					
63	52				do.					
62	52				do.					

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
			1915.		*Fms.*	
H. 5960	Grays Harbor Lt., S. 64° E., 40 miles.	C. S. 6400	July 24	6.17 p.m.	217	fne. gy. S., gn. M..
H. 5961	Grays Harbor Lt., S. 62° E., 35.6 miles.	C. S. 6400	July 26	1.07 p.m.	96	fne. wh. S., bk. Sp.
H. 5962	Grays Harbor Lt., S. 62° E., 36.7 miles.	C. S. 6400	...do.....	1.21 p.m.	162	bl. M.............
H. 5963	Grays Harbor Lt., S. 60½° E., 36.8 miles.	C. S. 6400	...do.....	1.38 p.m.	$\frac{0}{200}$	....
H. 5964	Grays Harbor Lt., S. 59° E., 37 miles.	C. S. 6400	...do.....	1.53 p.m.	$\frac{0}{200}$	....
H. 5965	Grays Harbor Lt., S. 57½° E., 37.2 miles.	C. S. 6400	...do.....	2.10 p.m.	$\frac{0}{200}$	....
H. 5966	Grays Harbor Lt., S. 56° E., 37.5 miles.	C. S. 6400	...do.....	2.24 p.m.	$\frac{0}{200}$	....
H. 5967	Grays Harbor Lt., S. 54½° E., 37.2 miles.	C. S. 6400	...do.....	2.39 p.m.	115	crs. bk. S., gn. M..
H. 5968	Grays Harbor Lt., S. 53° E., 37.1 miles.	C. S. 6400	...do.....	2.53 p.m.	110	....
H. 5969	Grays Harbor Lt., S. 51½° E., 36.9 miles.	C. S. 6400	...do.....	3.06 p.m.	$\frac{0}{200}$	....
H. 5970	Destruction Id. Lt., N. 29° E., 26.1 miles.	C. S. 6400	...do.....	3.21 p.m.	$\frac{0}{200}$	....
H. 5971	Destruction Id. Lt., N. 28½° E., 25.2 miles.	C. S. 6400	...do.....	3.35 p.m.	77	fne. wh. S., gn. M.
H. 5972	Destruction Id. Lt., N. 29° E., 24.2 miles.	C. S. 6400	...do.....	3.50 p.m.	68	gn. M............
H. 5973	Destruction Id. Lt., N. 30° E., 23.2 miles.	C. S. 6400	...do.....	4.03 p.m.	64	.....do............
H. 5974	Destruction Id. Lt., N. 31° E., 21.6 miles.	C. S. 6400	...do.....	4.20 p.m.	59	fne. bk. S., gn. M..
H. 5975	Destruction Id. Lt., N. 33° E., 23.5 miles.	C. S. 6400	...do.....	4.44 p.m.	75	gn. M............
H. 5976	Destruction Id. Lt., N. 34½° E., 25.5 miles.	C. S. 6400	...do.....	5.03 p.m.	$\frac{0}{200}$	....
H. 5977	Destruction Id. Lt., N. 36° E., 26.4 miles.	C. S. 6400	...do.....	5.25 p.m.	$\frac{0}{200}$	....
H. 5978	Destruction Id. Lt., N. 37° E., 27.4 miles.	C. S. 6400	...do.....	5.44 p.m.	$\frac{0}{200}$	....
H. 5979	Grays Harbor Lt., N. 57½° E., 39.3 miles.	C. S. 6400	...do.....	6.06 p.m.	$\frac{0}{200}$	....
H. 5980	Grays Harbor Lt., N. 60° E., 38.5 miles.	C. S. 6400	...do.....	6.25 p.m.	$\frac{0}{200}$	....
H. 5981	Destruction Id. Lt., S. 73½° E., 22.8 miles.	C. S. 6400	July 27	8.29 a.m.	82	gy. S.............
H. 5982	Destruction Id. Lt., S. 74° E., 23.8 miles.	C. S. 6400	...do.....	8.49 a.m.	128	fne. bk. G., gn. M. gran. Shl.
H. 5983	Destruction Id. Lt., S. 72° E., 25.8 miles.	C. S. 6400	...do.....	9.14 a.m.	$\frac{0}{200}$	....
H. 5984	Destruction Id. Lt., S. 70° E., 27.7 miles.	C. S. 6400	...do.....	9.35 a.m.	137	fne. gy. S., gran Shl.
H. 5985	Destruction Id. Lt., S. 68° E., 29.5 miles.	C. S. 6400	...do.....	9.57 a.m.	120	fne. gn. S.........
H. 5986	Umatilla Lightship, N. 41° E., 22.1 miles.	C. S. 6400	...do.....	10.17 a.m.	105	crs. bk. S., fne. gn. S.
H. 5987	Umatilla Lightship, N. 46° E., 21.9 miles.	C. S. 6400	...do.....	10.37 a.m.	128	fne. gn. S. ....
H. 5988	Umatilla Lightship, N. 51° E., 21.8 miles.	C. S. 6400	...do.....	10.58 a.m.	176	gn. M............
H. 5989	Umatilla Lightship, N. 53½° E., 21.3 miles.	C. S. 6400	...do.....	11.13 a.m.	91	R., G., crs. and fne. gy. S.
H. 5990	Umatilla Lightship, N. 56° E., 20.7 miles.	C. S. 6400	...do.....	11.25 a.m.	95	G., crs. and fne. gy. S.
H. 5991	Destruction Id. Lt., S. 70½° E., 41.5 miles.	P. S. #9	Aug. 10	5.44 a.m.	549	rky..............
H. 5992	Destruction Id. Lt., S. 74½° E., 45 miles.	P. S. #9	...do.....	6.32 a.m.	$\frac{0}{500}$	....
H. 5993	Destruction Id. Lt., S. 78° E., 48.9 miles.	P. S. #9	...do.....	7.24 a.m.	$\frac{0}{500}$	....
H. 5994	Destruction Id. Lt., S. 80½° E., 53 miles.	P. S. #9	...do.....	8.12 a.m.	$\frac{0}{500}$	....

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
62	52				El. sdr.; 30-lb. lead.					
60	52				do					
60	52				do					
60	52				do					
60	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					Lost the lead and a few feet of wire.
61	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					
61	52				do					
60	52				do					
60	52				do					
60	52				do					
60	52				do					
60	52				do					
58	50				do					
58	50				do					
59	51				do					
59	51				do					
59	51				do					
57	51				do					
57	51				do					
59	51				do					
59	51				do					
59	*54.5	44.05	32.56	34.40	El. sdr.; 30-lb. lead; Ek. bot.; 4′ inter.; #12, #20; NZ; 2 skates.	botm	60			1st dory left, 11.26; 1st dory ret., 12.52. 2d dory left, 11.27; 2d dory ret., 1.33. Frozen herring bait. Vertical townet haul.
58	53				Luc. sdr.; Sigs. rod.					Weight failed to trip.
58	53				Luc. sdr.; 30-lb. lead.					
62	54				do					
64	54				do					

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
H. 5995	Destruction Id. Lt., S. 83° E., 57.2 miles.	P. S. #9	1915. Aug. 10	8.59 a. m.	*Fms.* $\frac{0}{500}$	
H. 5996	Destruction Id. Lt., S. 85½° E., 61.2 miles.	P. S. #9	...do.....	9.49 a. m.	750	gy. M.
H. 5997	Destruction Id. Lt., S. 87° E., 65.6 miles.	P. S. #9	...do.....	10.44 a. m.	$\frac{0}{500}$	
H. 5998	Destruction Id. Lt., S. 89° E., 70.2 miles.	P. S. #9	...do.....	11.27 a. m.	$\frac{0}{500}$	
H. 5999	Destruction Id. Lt., N. 89½° E., 74.5 miles.	P. S. #9	...do.....	12.16 p. m.	$\frac{0}{500}$	
H. 6000	Destruction Id. Lt., N. 88½° E., 79.2 miles.	P. S. #9	...do.....	1.05 p. m.	$\frac{0}{500}$	
H. 6001	Destruction Id. Lt., N. 87½° E., 83.3 miles.	P. S. #9	...do.....	1.54 p. m.	1,300	
H. 6002	Destruction Id. Lt., N. 86° E., 87.9 miles.	P. S. #9	...do.....	3.07 p. m.	$\frac{0}{500}$	
H. 6003	Destruction Id. Lt., N. 85¼° E., 92.6 miles.	P. S. #9	...do.....	3.57 p. m.	$\frac{0}{500}$	
H. 6004	Destruction Id. Lt., N. 84½° E., 97.2 miles.	P. S. #9	...do.....	4.46 p. m.	$\frac{0}{500}$	
H. 6005	Destruction Id. Lt., N. 84¾° E., 101.6 miles.	P. S. #9	...do.....	5.30 p. m.	$\frac{0}{500}$	
H. 6006	Destruction Id. Lt., N. 83° E., 106.4 miles.	P. S. #9	...do.....	6.14 p. m.	1,400	
H. 6007	Destruction Id. Lt., N. 82½° E., 110.8 miles.	P. S. #9	...do.....	7.19 p. m.	$\frac{0}{500}$	
H. 6008	Destruction Id. Lt., N. 82° E., 115.5 miles.	P. S. #9	...do.....	8.06 p. m.	$\frac{0}{500}$	
H. 6009	Destruction Id. Lt., N. 81½° E., 120.3 miles.	P. S. #9	...do.....	8.53 p. m.	$\frac{0}{500}$	
H. 6010	Destruction Id. Lt., N. 81° E., 124.9 miles.	P. S. #9	...do.....	9.40 p. m.	$\frac{0}{500}$	
H. 6011	Destruction Id. Lt., N. 80½° E., 129.4 miles.	P. S. #9	...do.....	10.29 p. m.	1,480	gn. M.
H. 6012	Destruction Id. Lt., N. 80° E., 134 miles.	P. S. #9	...do.....	11.35 p. m.	$\frac{0}{500}$	
H. 6013	Destruction Id. Lt., N. 79½° E., 138.9 miles.	P. S. #9	Aug. 11	12.22 a. m.	$\frac{0}{500}$	
H. 6014	Destruction Id. Lt., N. 79° E., 143.5 miles.	P. S. #9	...do.....	1.09 a. m.	$\frac{0}{500}$	
H. 6015	Destruction Id. Lt., N. 78½° E., 148.3 miles.	P. S. #9	...do.....	1.55 a. m.	$\frac{0}{500}$	
H. 6016	Destruction Id. Lt., N. 78¼° E., 153 miles.	P. S. #9	...do.....	2.41 a. m.	1,490	gn. M.
H. 6017	Destruction Id. Lt., N. 78° E., 157.8 miles.	P. S. #9	...do.....	3.51 a. m.	$\frac{0}{500}$	
H. 6018	Destruction Id. Lt., N. 77¾° E., 162.3 miles.	P. S. #9	...do.....	4.44 a. m.	$\frac{0}{500}$	
H. 6019	Destruction Id. Lt., N. 77½° E., 167.1 miles.	P. S. #9	...do.....	5.30 a. m.	$\frac{0}{500}$	
H. 6020	Destruction Id. Lt., N. 77¼° E., 172 miles.	P. S. #9	...do.....	6.16 a. m.	$\frac{0}{500}$	
H. 6021	Destruction Id. Lt., N. 77° E., 176.6 miles.	P. S. #9	...do.....	7.04 a. m.	1,470	gy. M.
H. 6022	Destruction Id. Lt., N. 76¾° E., 181.2 miles.	P. S. #9	...do.....	8.10 a. m.	$\frac{0}{500}$	
H. 6023	Destruction Id. Lt., N. 76½° E., 185.9 miles.	P. S. #9	...do.....	9.00 a. m.	$\frac{0}{500}$	
H. 6024	Destruction Id. Lt., N. 76¼° E., 190.8 miles.	P. S. #9	...do.....	9.53 a. m.	$\frac{0}{500}$	
H. 6025	Destruction Id. Lt., N. 76° E., 196 miles.	P. S. #9	...do.....	10.44 a. m.	$\frac{0}{500}$	
H. 6026	Destruction Id. Lt., N. 75¾° E., 201.5 miles.	P. S. #9	...do.....	11.20 a. m.	1,300	

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
70	54				Luc. sdr.; 30-lb lead.					
68	54				Luc. sdr.; Sigs. rod.					
68	54				Luc. sdr.; 30-lb. lead.					
69	56				do.					
69	56				do.					
67	56				do.					
67	56				Luc. sdr.; Sigs. rod.					Stray line and sampler lost. Wire broke when register read 20 fms., probably due to kink. One kink found in wire about 2 fms. above break.
67	56				Luc. sdr.; 30-lb. lead.					
67	56				do.					
65	56				do.					
65	56				do.					
66	56				Luc. sdr.; Sigs. rod.					Sounding cup wrecked when hove against fairleader; botm. sample lost.
63	55				Luc. sdr.; 30-lb. lead.					
62	55				do.					
64	56				do.					
64	56				do.					
62	56				Luc. sdr.; Sigs. rod.					Shot did not trip but came up with sounding cup.
62	56				Luc. sdr.; 30-lb. lead.					
62	56				do.					
60	55				do.					
60	54				do.					
59	53				Luc. sdr.; Sigs. rod.					Shot did not detach.
59	53				Luc. sdr.; 30-lb. lead.					
59	53				do.					
59	53				do.					
60	54				do.					
62	54				Luc. sdr.; Sigs. rod.					Weight did not detach.
63	55				Luc. sdr.; 30-lb. lead.					
65	56				do.					
67	56				do.					
69	57				do.					
71	57				Luc. sdr.; Sigs. rod.					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
			1915.		*Fms.*	
H. 6027	Destruction Id. Lt., N. 75° 43′ E., 206.4 miles.	P. S. #9	Aug. 11	12.31 p. m.	$\frac{0}{500}$	
H. 6028	Destruction Id. Lt., N. 75° 41′ E., 211.2 miles.	P. S. #9	...do.....	1.21 p. m.	$\frac{0}{500}$	
H. 6029	Destruction Id. Lt., N. 75° 39′ E., 215.9 miles.	P. S. #9	...do.....	2.11 p. m.	$\frac{0}{500}$	
H. 6030	Destruction Id. Lt., N. 75° 37′ E., 220.3 miles.	P. S. #9	...do.....	3.01 p. m.	$\frac{0}{500}$	
H. 6031	Destruction Id. Lt., N. 75° 35′ E., 224.9 miles.	P. S. #9	...do.....	3.50 p. m.	1,480	fne. bk. S., bn. M.
H. 6032	Destruction Id. Lt., N. 75° 33′ E., 229.3 miles.	P. S. #9	...do.....	5.03 p. m.	$\frac{0}{500}$	
H. 6033	Destruction Id. Lt., N. 75° 31′ E., 233.9 miles.	P. S. #9	...do.....	5.54 p. m.	$\frac{0}{500}$	
H. 6034	Destruction Id. Lt., N. 75° 29′ E., 238.8 miles.	P. S. #9	...do.....	6.43 p. m.	$\frac{0}{500}$	
H. 6035	Destruction Id. Lt., N. 75° 27′ E., 243.4 miles.	P. S. #9	...do.....	7.31 p. m.	$\frac{0}{500}$	
H. 6036	Destruction Id. Lt., N. 75° 25′ E., 248 miles.	P. S. #9	...do.....	8.24 p. m.	1,518	bn. M.
H. 6037	Destruction Id. Lt., N. 75° 23′ E., 252.8 miles.	P. S. #9	...do.....	9.33 p. m.	$\frac{0}{500}$	
H. 6038	Destruction Id. Lt., N. 75° 21′ E., 257.4 miles.	P. S. #9	...do.....	10.23 p. m.	$\frac{0}{500}$	
H. 6039	Destruction Id. Lt., N. 75° 19′ E., 262 miles.	P. S. #9	...do.....	11.13 p. m.	$\frac{0}{500}$	
H. 6040	Destruction Id. Lt., N. 75° 17′ E., 266.8 miles.	P. S. #9	Aug. 12	12.01 a. m.	$\frac{0}{500}$	
H. 6041	Destruction Id. Lt., N. 75° 15′ E., 271.5 miles.	P. S. #9	...do.....	12.53 a. m.	635	bn. M., For.
H. 6042	Destruction Id. Lt., N. 75° 14′ E., 273.8 miles.	P. S. #9	...do.....	1.26 a. m.	525	
H. 6043	Destruction Id. Lt., N. 75° 13′ E., 276.5 miles.	P. S. #9	...do.....	1.54 a. m.	830	bn. M.
H. 6044	Destruction Id. Lt., N. 75° 45′ E., 275.5 miles.	P. S. #9	...do.....	2.47 a. m.	$\frac{0}{600}$	
H. 6045	Destruction Id. Lt., N. 75° 30′ E., 272.5 miles.	P. S. #9	...do.....	3.46 a. m.	$\frac{0}{700}$	
H. 6046	Destruction Id. Lt., N. 75° 30′ E., 274.7 miles.	P. S. #9	...do.....	4.25 a. m.	$\frac{0}{700}$	
H. 6047	Destruction Id. Lt., N. 75° 11′ E., 280.9 miles.	P. S. #9	...do.....	5.36 a. m.	$\frac{0}{500}$	
H. 6048	Destruction Id. Lt., N. 75° 09′ E., 285.8 miles.	P. S. #9	...do.....	6.29 a. m.	$\frac{0}{500}$	
H. 6049	Destruction Id. Lt., N. 75° 07′ E., 290.8 miles.	P. S. #9	...do.....	7.17 a. m.	$\frac{0}{500}$	
H. 6050	Destruction Id. Lt., N. 75° 05′ E., 294.9 miles.	P. S. #9	...do.....	8.07 a. m.	$\frac{0}{500}$	
H. 6051	Destruction Id. Lt., N. 75° 03′ E., 299.2 miles.	P. S. #9	...do.....	8.55 a. m.	1,600	bn. M.
H. 6052	Destruction Id. Lt., N. 75° 02′ E., 303.5 miles.	P. S. #9	...do.....	10.18 a. m.	$\frac{0}{500}$	
H. 6053	Destruction Id. Lt., N. 75° 01′ E., 308 miles.	P. S. #9	...do.....	11.06 a. m.	$\frac{0}{500}$	
H. 6054	Destruction Id. Lt., N. 75° E., 312.8 miles.	P. S. #9	...do.....	11.45 a. m.	$\frac{0}{500}$	
H. 6055	Tatoosh Id. Lt., N. 68° E., 317.3 miles.	P. S. #9	...do.....	12.41 p. m.	$\frac{0}{500}$	
H. 6056	Tatoosh Id. Lt., N. 68° 50′ E., 317.3 miles.	P. S. #9	...do.....	1.31 p. m.	$\frac{0}{500}$	
H. 6057	Tatoosh Id. Lt., N. 69° 40′ E., 317.3 miles.	P. S. #9	...do.....	2.21 p. m.	$\frac{0}{500}$	
H. 6058	Tatoosh Id. Lt., N. 70½° E., 317.3 miles.	P. S. #9	...do.....	3.10 p. m.	1,774	bk. M.
H. 6059	Tatoosh Id. Lt., N. 70° 31′ 27″ E., 311.6 miles.	P. S. #9	...do.....	4.33 p. m.	$\frac{0}{500}$	
H. 6060	Tatoosh Id. Lt., N. 70° 32′ 53″ E., 306 miles.	P. S. #9	...do.....	5.25 p. m.	$\frac{0}{500}$	
H. 6061	Tatoosh Id. Lt., N. 70° 34′ 20″ E., 300.6 miles.	P. S. #9	...do.....	6.12 p. m.	$\frac{0}{500}$	
H. 6062	Tatoosh Id. Lt., N. 70° 35′ 46″ E., 295.2 miles.	P. S. #9	...do.....	7.00 p. m.	$\frac{0}{500}$	
H. 6063	Tatoosh Id. Lt., N. 70° 37′ 13″ E., 289.8 miles.	P. S. #9	...do.....	7.51 p. m.	1,445	bn. M., For.
H. 6064	Tatoosh Id. Lt., N. 70° 38′ 39″ E., 284.3 miles.	P. S. #9	...do.....	9.04 p. m.	$\frac{0}{500}$	

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
71	57				Luc. sdr.; 30-lb. lead.					
67	58				do					
67	58				do					
66	57				do					
66	57				Luc. sdr.; Sigs. rod.					
66	57				Luc. sdr.; 30-lb. lead.					
64	55				do					
64	55				do					
64	55				do					
59	54				Luc. sdr.; Sigs. rod.					Weight returned.
57.5	54				Luc. sdr.; 30-lb. lead.					
57	54				do					
56	53				do					
56	53				do					
61	54				Luc. sdr.; Sigs. rod.					
64	54				do					Lost sounder.
63	54				Luc. sdr.; 30-lb. lead.					
62	54				do					
62	55				do					
62	55				do					
63	55				do					
64	55				do					
66	55				do					
68	55				do					
71	56				Luc. sdr.; Sigs. rod.					Weight returned.
72	56				Luc. sdr.; 30-lb. lead.					
72	56				do					
72	56				do					
72	57				do					
73	57				do					
73	57				do					
71	57				Luc. sdr.; Sigs. rod.					Do.
68	57				Luc. sdr.; 30-lb. lead.					
68	57				do					
69	56				do					
66	55				do					
64	55				Luc. sdr.; Sigs. rod.					
60	55				Luc. sdr.; 30-lb. lead.					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
			1915.		*Fms.*	
H. 6065	Tatoosh Id. Lt., N. 70° 40′ 06″ E., 278.8 miles.	P. S. #9	Aug. 12	9.54 p. m.	$\frac{0}{800}$	....
H. 6066	Tatoosh Id. Lt., N. 70° 41′ 32″ E., 273.3 miles.	P. S. #9	...do.....	10.52 p.m.	$\frac{0}{800}$	....
H. 6067	Tatoosh Id. Lt., N. 70° 42′ 59″ E., 267.7 miles.	P. S. #9	...do.....	11.48 p. m.	$\frac{0}{800}$	....
H. 6068	Tatoosh Id. Lt., N. 70° 44′ 25″ E., 262 miles.	P. S. #9	Aug. 13	12.46 a. m.	1,644	bn. M., For.......
H. 6069	Tatoosh Id. Lt., N. 70° 45′ 52″ E., 256.6 miles.	P. S. #9	...do.....	2.03 a. m.	$\frac{0}{500}$	....
H. 6070	Tatoosh Id. Lt., N. 70° 47′ 18″ E., 251.2 miles.	P. S. #9	...do.....	2.51 a. m.	$\frac{0}{500}$	....
H. 6071	Tatoosh Id. Lt., N. 70° 48′ 45″ E., 245.5 miles.	P. S. #9	...do.....	3.42 a. m.	$\frac{0}{500}$	....
H. 6072	Tatoosh Id. Lt., N. 70° 50′ 12″ E., 240.3 miles.	P. S. #9	...do.....	4.32 a. m.	$\frac{0}{500}$	....
H. 6073	Tatoosh Id. Lt., N. 70° 51′ 38″ E., 234.5 miles.	P. S. #9	...do.....	5.20 a. m.	1,433	bn. M............
H. 6074	Tatoosh Id. Lt., N. 70° 53′ 05″ E., 228.8 miles.	P. S. #9	...do.....	6.29 a. m.	$\frac{0}{500}$	....
H. 6075	Tatoosh Id. Lt., N. 70° 54′ 31″ E., 223.5 miles.	P. S. #9	...do.....	7.16 a. m.	$\frac{0}{500}$	....
H. 6076	Tatoosh Id. Lt., N. 70° 55′ 58″ E., 217.7 miles.	P. S. #9	...do.....	8.05 a. m.	$\frac{0}{500}$	....
H. 6077	Tatoosh Id. Lt., N. 70° 57′ 24″ E., 212.7 miles.	P. S. #9	...do.....	8.53 a. m.	$\frac{0}{500}$	....
H. 6078	Tatoosh Id. Lt., N. 70° 58′ 51″ E., 207.8 miles.	P. S. #9	...do.....	9.41 a. m.	1,530	bn. M., For.......
H. 6079	Tatoosh Id. Lt., N. 71° 00′ 17″ E., 202.5 miles.	P. S. #9	...do.....	10.50 a. m.	$\frac{0}{500}$	....
H. 6080	Tatoosh Id. Lt., N. 71° 01′ 44″ E., 197.5 miles.	P. S. #9	...do.....	11.44 a. m.	$\frac{0}{500}$	....
H. 6081	Tatoosh Id. Lt., N. 71° 03′ 10″ E., 192.2 miles.	P. S. #9	...do.....	12.36 p. m.	$\frac{0}{500}$	....
H. 6082	Tatoosh Id. Lt., N. 71° 04′ 37″ E., 187.2 miles.	P. S. #9	...do.....	1.25 p. m.	$\frac{0}{500}$	....
H. 6083	Tatoosh Id. Lt., N. 71° 06′ 03″ E., 182.4 miles.	P. S. #9	...do.....	2.13 p. m.	1,330	....
H. 6084	Tatoosh Id. Lt., N. 71° 07′ 30″ E., 177.4 miles.	P. S. #9	...do.....	3.31 p. m.	$\frac{0}{500}$	....
H. 6085	Tatoosh Id. Lt., N. 71° 08′ 57″ E., 172.3 miles.	P. S. #9	...do.....	4.18 p. m.	$\frac{0}{500}$	....
H. 6086	Tatoosh Id. Lt., N. 71° 10′ 23″ E., 167.5 miles.	P. S. #9	...do.....	5.04 p.m.	$\frac{0}{500}$	....
H. 6087	Tatoosh Id. Lt., N. 71° 11′ 50″ E., 162.3 miles.	P. S. #9	...do.....	5.49 p. m.	$\frac{0}{500}$	....
H. 6088	Tatoosh Id. Lt., N. 71° 13′ 16″ E., 157.3 miles.	P. S. #9	...do.....	6.39 p. m.	1,457	bn. M., For.......
H. 6089	Tatoosh Id. Lt., N. 71° 14′ 43″ E., 152.4 miles.	P. S. #9	...do.....	7.51 p. m.	$\frac{0}{500}$	....
H. 6090	Tatoosh Id. Lt., N. 71° 16′ 09″ E., 147.3 miles.	P. S. #9	...do.....	8.41 p. m.	$\frac{0}{500}$	....
H. 6091	Tatoosh Id. Lt., N. 71° 17′ 36″ E., 142 miles.	P. S. #9	...do.....	9.29 p. m.	$\frac{0}{500}$	....
H. 6092	Tatoosh Id. Lt., N. 71° 19′ 02″ E., 137.5 miles.	P. S. #9	...do.....	10.16 p. m.	$\frac{0}{500}$	....
H. 6093	Tatoosh Id. Lt., N. 71° 20′ 29″ E., 132.2 miles.	P. S. #9	...do.....	11.05 p. m.	1,450	bn. M., For.......
H. 6094	Tatoosh Id. Lt., N. 71° 21′ 55″ E., 127.1 miles.	P. S. #9	Aug. 14	12.21 a. m.	$\frac{0}{500}$	....
H. 6095	Tatoosh Id. Lt., N. 71° 23′ 22″ E., 122.1 miles.	P. S. #9	...do.....	1.09 a. m.	$\frac{0}{500}$	....
H. 6096	Tatoosh Id. Lt., N. 71° 24′ 48″ E., 117.1 miles.	P. S. #9	...do.....	1.54 a. m.	$\frac{0}{500}$	....
H. 6097	Tatoosh Id. Lt., N. 71° 26′ 15″ E., 112.1 miles.	P. S. #9	...do.....	2.40 a. m.	$\frac{0}{500}$	....
H. 6098	Tatoosh Id. Lt., N. 71° 27′ 42″ E., 107.2 miles.	P. S. #9	...do.....	3.26 a. m.	1,430	bn. M., For.......
H. 6099	Tatoosh Id. Lt., N. 71° 29′ 08″ E., 102.2 miles.	P. S. #9	...do.....	4.32 a. m.	$\frac{0}{500}$	....
H. 6100	Tatoosh Id. Lt., N. 71° 30′ 35″ E., 97.4 miles.	P. S. #9	...do.....	5.22 a. m.	$\frac{0}{500}$	....
H. 6101	Tatoosh Id. Lt., N. 71° 32′ 01″ E., 92.2 miles.	P. S. #9	...do.....	6.14 a. m.	$\frac{0}{500}$	....

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
60	55				Luc. sdr.; 30-lb. lead.					
60	55				do.					
60	55				do.					
58	54				Luc. sdr.; Sigs. rod.					Weight returned.
58	54				Luc. sdr.; 30-lb. lead.					
59	54				do.					
59	54				do.					
60	54				do.					
62	54				Luc. sdr.; Sigs. rod.					Do.
66	54				Luc. sdr.; 30-lb. lead.					
67	55				do.					
68	56				do.					
64	56				do.					
66	56				Luc. sdr.; Sigs. rod.					
66	56				Luc. sdr.; 30-lb. lead.					
66	56				do.					
68	56				do.					
70	56				do.					
71	56				Luc. sdr.; Sigs. rod.					Register read 175 fms. when sdr. reached surface.
71	56				Luc. sdr.; 30-lb. lead.					
70	56				do.					
68	56				do.					
66	56				do.					
66	56				Luc. sdr.; Sigs. rod.					
63	55				Luc. sdr.; 30-lb. lead.					
66	54				do.					
66	54				do.					
57	53				do.					
57	53				Luc. sdr.; Sigs. rod.					
57	53				Luc. sdr.; 30-lb. lead.					
57	53				do.					
57	53				do.					
56	53				do.					
56	53				Luc. sdr.; Sigs. rod.					Weight returned.
58	53				Luc. sdr.; 30-lb. lead.					
58	53				do.					
62	54				do.					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
			1915.		*Fms.*	
H. 6102	Tatoosh Id. Lt., N. 71° 33′ 28″ E., 87.3 miles.	P. S. #9	Aug. 14	7.04 a. m.	$\frac{0}{500}$	....
H. 6103	Tatoosh Id. Lt., N. 71° 34′ 54″ E., 82.1 miles.	P. S. #9	...do.....	7.50 a. m.	1,268	gn. M............
H. 6104	Tatoosh Id. Lt., N. 71° 36′ 21″ E., 77.3 miles.	P. S. #9	...do.....	8.57 a. m.	$\frac{0}{500}$	....
H. 6105	Tatoosh Id. Lt., N. 71° 37′ 47″ E., 72.3 miles.	P. S. #9	...do.....	9 45 a. m.	$\frac{0}{500}$	....
H. 6106	Tatoosh Id. Lt., N. 71° 39′ 14″ E., 67.3 miles.	P. S. #9	...do.....	10.33 a. m.	$\frac{0}{500}$	....
H. 6107	Tatoosh Id. Lt., N. 71° 40′ 40″ E., 62.4 miles.	P. S. #9	...do.....	11.33 a. m.	$\frac{0}{500}$	....
H. 6108	Tatoosh Id. Lt., N. 71° 42′ 07″ E., 57.5 miles.	P. S. #9	...do.....	12.20 p. m.	650	gn. M............
H. 6109	Tatoosh Id. Lt., N. 71° 43′ 33″ E., 52.5 miles.	P. S. #9	...do.....	1.10 p. m.	490	....
H. 6110	Tatoosh Id. Lt., N. 71° 45′ E., 47.7 miles.	P. S. #9	...do.....	1.57 p. m.	240	gran. Shl..........
H. 6111	Pachena Pt. Lt., N. 66° 40′ E., 41.7 miles.	P. S. #9	...do.....	4.56 p m.	210	gy. S..............
H. 6112	Pachena Pt. Lt., N. 66° 45′ E., 46.7 miles.	P. S. #9	...do.....	5.40 p. m.	300	fne. gy. S.........
H. 6113	Pachena Pt. Lt., N. 67° E., 51.5 miles.	P. S. #9	...do.....	6.25 p. m.	390	crs. and fne. gy. S.
H. 6114	Pachena Pt. Lt., N. 67° 5′ E., 56.3 miles.	P. S. #9	...do.....	7.12 p. m.	724	gy. S., G..........
H. 6115	Pachena Pt. Lt., N. 67° 30′ E., 61 miles.	P. S. #9	...do.....	8.45 p. m.	$\frac{0}{500}$	....
H. 6116	Pachena Pt. Lt., N. 67° 45′ E., 65.9 miles.	P. S. #9	...do.....	9.34 p. m.	$\frac{0}{500}$	....
H. 6117	Pachena Pt. Lt., N. 68° E., 70.8 miles.	P. S. #9	...do.....	10.24 p. m.	$\frac{0}{500}$	....
H. 6118	Pachena Pt. Lt., N. 68° 5′ E., 75.1 miles.	P. S. #9	...do.....	11.12 p. m.	$\frac{0}{500}$	....
H. 6119	Pachena Pt. Lt., N. 68° 25′ E., 79.7 miles.	P. S. #9	Aug. 15	12.01 a. m.	1,400	gn. M............
H. 6120	Pachena Pt. Lt., N. 68° 45′ E., 83.9 miles.	P. S. #9	...do.....	1.10 a. m.	$\frac{0}{500}$	....
H. 6121	Pachena Pt. Lt., N. 68° 48′ E., 88.8 miles.	P. S. #9	...do.....	2.02 a. m.	$\frac{0}{500}$	....
H. 6122	Pachena Pt. Lt., N. 68° 51′ E., 94 miles.	P. S. #9	...do.....	2.53 a. m.	$\frac{0}{500}$	....
H. 6123	Pachena Pt. Lt., N. 68° 54′ E., 98.5 miles.	P. S. #9	...do.....	3.41 a. m.	$\frac{0}{500}$	....
H. 6124	Pachena Pt. Lt., N. 68° 57′ E., 103 miles.	P. S. #9	...do.....	5.15 a. m.	1,455	bn. M., For.......
H. 6125	Pachena Pt. Lt., N. 69° E., 108 miles.	P. S. #9	...do.....	6.24 a. m.	$\frac{0}{500}$	....
H. 6126	Pachena Pt. Lt., N. 69° E., 112.5 miles.	P. S. #9	...do.....	7.11 a. m.	$\frac{0}{500}$	....
H. 6127	Pachena Pt. Lt., N. 69° E., 117.6 miles.	P. S. #9	...do.....	7.56 a. m.	$\frac{0}{500}$	....
H. 6128	Pachena Pt. Lt., N. 69° 1′ 40″ E., 122.1 miles.	P. S. #9	...do.....	8.45 a. m.	$\frac{0}{500}$	....
H. 6129	Pachena Pt. Lt., N. 69° 2′ 26″ E., 127.1 miles.	P. S. #9	...do.....	9.33 a. m.	1,450	bn. M., For.......
H. 6130	Pachena Pt. Lt., N. 69° 5′ E., 131.7 miles.	P. S. #9	...do.....	10.41 a. m.	$\frac{0}{500}$	....
H. 6131	Pachena Pt. Lt., N. 69° 10′ E., 136.7 miles.	P. S. #9	...do.....	11.29 a. m.	$\frac{0}{500}$	....
H. 6132	Pachena Pt. Lt., N. 69° 15′ E., 141.1 miles.	P. S. #9	...do.....	12.09 p. m.	$\frac{0}{500}$	....
H. 6133	Pachena Pt. Lt., N. 69° 20′ E., 146 miles.	P. S. #9	...do.....	1.02 p. m.	$\frac{0}{500}$	....
H. 6134	Pachena Pt. Lt., N. 69° 25′ E., 150.7 miles.	P. S. #9	...do.....	1.50 p. m.	1,445	bn. M., For.......
H. 6135	Pachena Pt. Lt., N. 69° 30′ E., 155.7 miles.	P. S. #9	...do.....	2.54 p. m.	$\frac{0}{500}$	....
H. 6136	Pachena Pt. Lt., N. 69° 32′ E., 160.5 miles.	P. S. #9	...do.....	3.46 p. m.	$\frac{0}{500}$	....

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
62	54				Luc. sdr.; 30-lb. lead.					
67	55				Luc. sdr.; Sigs. rod.					
63	56				Luc. sdr.; 30-lb. lead.					
63	56				do.					
63	56				do.					
64	56				do.					
64	56				Luc. sdr.; Sigs. rod.					
64	56				Luc. sdr.; 30-lb. lead.					Register read 20 fms. when lead was in. No botm. sample.
62	56				do.					
67	56				do.					
67	56				do.					
67	56				do.					
67	56				do.					G. sample lost.
64	55				do.					
63	54				do.					
62	54				do.					
61	54				do.					
61	54				Luc. sdr.; Sigs. rod.					Register read 15 fms. when all wire was hove in.
60	53				Luc. sdr.; 30-lb. lead.					
60	53				do.					
60	54				do.					
60	54				do.					
61	54				Luc. sdr.; Sigs. rod.					Sounding rod and 5 fms. wire carried away because of kink in wire; repairs made and operations continued.
61	55				Luc. sdr.; 30-lb. lead.					
68	55				do.					
69	56				do.					
70	56				do.					
69	56				Luc. sdr.; Sigs. rod.					Weight returned.
69	56				Luc. sdr.; 30-lb. lead.					
71	56				do.					
72	57				do.					
67	56				do.					
64	56				Luc. sdr.; Sigs. rod.					
63	58				Luc. sdr.; 30-lb. lead.					
63	58				do.					

Dredging and Hydrographic Records Secured During Halibut

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
			1915.		*Fms.*	
H. 6137	Pachena Pt. Lt., N. 69° 34′ E., 165.2 miles.	P. S. #9	Aug. 15	4.34 p. m.	$\frac{0}{500}$	
H. 6138	Pachena Pt. Lt., N. 69° 36′ E., 169.6 miles.	P. S. #9	...do.....	5.21 p. m.	$\frac{0}{500}$	
H. 6139	Pachena Pt. Lt., N. 69° 38′ E., 174.5 miles.	P. S. #9	...do.....	6.17 p. m.	1,430	bn. M.
H. 6140	Pachena Pt. Lt., N. 69° 40′ E., 179.2 miles.	P. S. #9	...do.....	7.15 p. m.	$\frac{0}{500}$	
H. 6141	Pachena Pt. Lt., N. 69° 42′ E., 184 miles.	P. S. #9	...do.....	8.02 p. m.	$\frac{0}{500}$	
H. 6142	Pachena Pt. Lt., N. 69° 44′ E., 189 miles.	P. S. #9	...do.....	8.49 p. m.	$\frac{0}{500}$	
H. 6143	Pachena Pt. Lt., N. 69° 46′ E., 193.8 miles.	P. S. #9	...do.....	9.37 p. m.	$\frac{0}{500}$	
H. 6144	Pachena Pt. Lt., N. 69° 48′ E., 198.6 miles.	P. S. #9	...do.....	10.26 p. m.	1,438	bn. M., For.
H. 6145	Pachena Pt. Lt., N. 69° 50′ E., 203.5 miles.	P. S. #9	...do.....	11.35 p. m.	$\frac{0}{500}$	
H. 6146	Pachena Pt. Lt., N. 69° 52′ E., 208.3 miles.	P. S. #9	Aug. 16..	12.28 a. m.	$\frac{0}{500}$	
H. 6147	Pachena Pt. Lt., N. 69° 54′ E., 213.8 miles.	P. S. #9	...do.....	1.16 a. m.	$\frac{0}{500}$	
H. 6148	Pachena Pt. Lt., N. 69° 56′ E., 218.7 miles.	P. S. #9	...do.....	2.03 a. m.	$\frac{0}{500}$	
H. 6149	Pachena Pt. Lt., N. 69° 58′ E., 223.7 miles.	P. S. #9	...do.....	2.53 a. m.	1,236	bn. M., For.
H. 6150	Pachena Pt. Lt., N. 70° E., 228.5 miles.	P. S. #9	...do.....	3.54 a. m.	$\frac{0}{500}$	
H. 6151	Pachena Pt. Lt., N. 70° E., 233.2 miles.	P. S. #9	...do.....	4.42 a. m.	1,532	bn. M., For.
H. 6152	Cape Beale Lt., N. 70° E., 230.3 miles.	P. S. #9	...do.....	5.52 a. m.	$\frac{0}{500}$	
H. 6153	Cape Beale Lt., N. 71° 15′ E., 230.3 miles.	P. S. #9	...do.....	6.37 a. m.	$\frac{0}{500}$	
H. 6154	Cape Beale Lt., N. 72½° E., 230.5 miles.	P. S. #9	...do.....	7.23 a. m.	$\frac{0}{500}$	
H. 6155	Cape Beale Lt., N. 73° 45′ E., 230.7 miles.	P. S. #9	...do.....	8.10 a. m.	$\frac{0}{500}$	
H. 6156	Cape Beale Lt., N. 73° 47′ 18″ E., 226 miles.	P. S. #9	...do.....	9.04 a. m.	1,600	bn. M., For.
H. 6157	Cape Beale Lt., N. 73° 49′ 37″ E., 221.3 miles.	P. S. #9	...do.....	10.20 a. m.	$\frac{0}{500}$	
H. 6158	Cape Beale Lt., N. 73° 51′ 55″ E., 216.8 miles.	P. S. #9	...do.....	11.08 a. m.	$\frac{0}{500}$	
H. 6159	Cape Beale Lt., N. 73° 54′ 14″ E., 211.9 miles.	P. S. #9	...do.....	11.46 a. m.	$\frac{0}{500}$	
H. 6160	Cape Beale Lt., N. 73° 56′ 32″ E., 207.2 miles.	P. S. #9	...do.....	12.34 p. m.	$\frac{0}{500}$	
H. 6161	Cape Beale Lt., N. 73° 58′ 51″ E., 202.5 miles.	P. S. #9	...do.....	1.21 p. m.	1,565	bn. M., For.
H. 6162	Cape Beale Lt., N. 74° 01′ 09″ E., 197.7 miles.	P. S. #9	...do.....	2.32 p. m.	$\frac{0}{500}$	
H. 6163	Cape Beale Lt., N. 74° E., 192.8 miles.	P. S. #9	...do.....	3.18 p. m.	$\frac{0}{500}$	
H. 6164	Cape Beale Lt., N. 74° E., 187.8 miles.	P. S. #9	...do.....	4.05 p. m.	$\frac{0}{500}$	
H. 6165	Cape Beale Lt., N. 74° E., 182.8 miles.	P. S. #9	...do.....	4.51 p. m.	$\frac{0}{500}$	
H. 6166	Pachena Pt. Lt., N. 74° 10′ 23″ E., 178.1 miles.	P. S. #9	...do.....	5.38 p. m.	1,387	yl. M., For.
H. 6167	Pachena Pt. Lt., N. 74° 12′ 42″ E., 172.8 miles.	P. S. #9	...do.....	6.44 p. m.	$\frac{0}{500}$	
H. 6168	Pachena Pt. Lt., N. 74° 15′ E., 167.5 miles.	P. S. #9	...do.....	7.34 p. m.	$\frac{0}{500}$	
H. 6169	Pachena Pt. Lt., N. 76° 15′ E., 165.8 miles.	P. S. #9	...do.....	8.28 p. m.	$\frac{0}{500}$	
H. 6170	Pachena Pt. Lt., N. 76° 15′ E., 160.8 miles.	P. S. #9	...do.....	9.15 p. m.	$\frac{0}{500}$	
H. 6171	Pachena Pt. Lt., N. 76° 15′ E., 156.3 miles.	P. S. #9	...do.....	10.05 p. m.	1,410	bn. M., For.
H. 6172	Pachena Pt. Lt., N. 76° 15′ E., 151.3 miles.	P. S. #9	...do.....	11.05 p. m.	$\frac{0}{500}$	
H. 6173	Pachena Pt. Lt., N. 76° 15′ E., 146.4 miles.	P. S. #9	...do.....	11.54 p. m.	$\frac{0}{500}$	

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
62	57	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
62	56	......	......	......	....do........	......	......	......	......	
61	55	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
60	55	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
58	54	......	......	......	....do........	......	......	......	......	
58	54	......	......	......	....do........	......	......	......	......	
57	54	......	......	......	....do........	......	......	......	......	
57	54	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
57	53	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
57	53	......	......	......	....do........	......	......	......	......	
60	53	......	......	......	....do........	......	......	......	......	
56	53	......	......	......	....do........	......	......	......	......	
56	52	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
56	52	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
58	53	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
59	54	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
59	54	......	......	......	....do........	......	......	......	......	
60	55	......	......	......	....do........	......	......	......	......	
64	55	......	......	......	....do........	......	......	......	......	
64	56	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
64	56	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
64	56	......	......	......	....do........	......	......	......	......	
64	56	......	......	......	....do........	......	......	......	......	
64	56	......	......	......	....do........	......	......	......	......	
65	57	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
65	57	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
64	57	......	......	......	....do........	......	......	......	......	
64	57	......	......	......	....do........	......	......	......	......	
63	56	......	......	......	....do........	......	......	......	......	
64	56	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
64	56	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
64	56	......	......	......	....do........	......	......	......	......	
60	54	......	......	......	....do........	......	......	......	......	
59	54	......	......	......	....do........	......	......	......	......	
58	54	......	......	......	Luc. sdr.; Sigs. rod.	......	......	......	......	
58	54	......	......	......	Luc. sdr.; 30-lb. lead.	......	......	......	......	
58	54	......	......	......	....do........	......	......	......	......	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
H. 6174	Pachena Pt. Lt., N. 76° 15′ E., 141.5 miles.	P. S. #9	1915. Aug. 17	12.44 a. m.	*Fms.* $\frac{0}{500}$	
H. 6175	Pachena Pt. Lt., N. 76° 15′ E., 136.8 miles.	P. S. #9	do	1.34 a. m.	$\frac{0}{500}$	
H. 6176	Pachena Pt. Lt., N. 76° 15′ E., 131.7 miles.	P. S. #9	do	2.22 a. m.	1,430	bn. M., For
H. 6177	Pachena Pt. Lt., N. 76° 15′ E., 126.9 miles.	P. S. #9	do	3.33 a. m.	$\frac{0}{500}$	
H. 6178	Pachena Pt. Lt., N. 76° 15′ E., 122.1 miles.	P. S. #9	do	4.29 a. m.	$\frac{0}{500}$	
H. 6179	Pachena Pt. Lt., N. 76° 15′ E., 117.3 miles.	P. S. #9	do	5.16 a. m.	$\frac{0}{500}$	
H. 6180	Pachena Pt. Lt., N. 76° E., 112.5 miles.	P. S. #9	do	6.03 a. m.	$\frac{0}{500}$	
H. 6181	Pachena Pt. Lt., N. 76° E., 107.8 miles.	P. S. #9	do	6.50 a. m.	1,439	bn. M., For
H. 6182	Pachena Pt. Lt., N. 76° E., 102.8 miles.	P. S. #9	do	7.59 a. m.	$\frac{0}{500}$	
H. 6183	Pachena Pt. Lt., N. 76° E., 98 miles.	P. S. #9	do	8.51 a. m.	$\frac{0}{500}$	
H. 6184	Pachena Pt. Lt., N. 76° E., 93.2 miles.	P. S. #9	do	9.40 a. m.	$\frac{0}{500}$	
H. 6185	Pachena Pt. Lt., N. 76° E., 88.2 miles.	P. S. #9	do	10.27 a. m.	$\frac{0}{500}$	
H. 6186	Pachena Pt. Lt., N. 75° 50′ E., 83.3 miles.	P. S. #9	do	11.13 a. m.	1,432	bn. M., For
H. 6187	Pachena Pt. Lt., N. 75° 50′ E., 78.4 miles.	P. S. #9	do	12.21 p. m.	$\frac{0}{500}$	
H. 6188	Pachena Pt. Lt., N. 78° E., 74 miles.	P. S. #9	do	1.22 p. m.	$\frac{0}{500}$	
H. 6189	Pachena Pt. Lt., N. 80° E., 69.8 miles.	P. S. #9	do	2.11 p. m.	$\frac{0}{500}$	
H. 6190	Pachena Pt. Lt., N. 82° 45′ E., 65.6 miles.	P. S. #9	do	2.59 p. m.	$\frac{0}{500}$	
H. 6191	Pachena Pt. Lt., N. 85° E., 61.7 miles.	P. S. #9	do	3.48 p. m.	705	gn. M
H. 6192	Pachena Pt. Lt., N. 88° 15′ E., 58 miles.	P. S. #9	do	4.38 p. m.	300	do
H. 6193	Pachena Pt. Lt., N. 88° 30′ E., 54.2 miles.	P. S. #9	do	5.24 p. m.	180	fne. gy. S
H. 6194	Cape Shoalwater Lt., N. 66° E., 20.8 miles.	*C. S.* 6100	Sept. 4	10.42 a. m.	169	gn. M
H. 6195	Cape Shoalwater Lt., N. 68° E., 21.5 miles.	6100	do	11.02 a. m.	207	gn. M., fne. bk. S
H. 6196	Cape Shoalwater Lt., N. 70° E., 22.4 miles.	6100	do	11.19 a. m.	191	gn. M., fne. gy. S
H. 6197	Cape Shoalwater Lt., N. 71° E., 23.4 miles.	6100	do	11.35 a. m.	177	fne. gn. S., gn. M
H. 6198	Cape Shoalwater Lt., N. 72½° E., 24.3 miles.	6100	do	11.53 a. m.	133	gy. M., bk. S
H. 6199	Cape Shoalwater Lt., N. 74° E., 25 miles.	6100	do	12.08 p. m.	$\frac{0}{300}$	
H. 6200	Cape Shoalwater Lt., N. 76° E., 24 miles.	6100	do	12.35 p. m.	284	gn. M., fne. gy. S
H. 6201	Cape Shoalwater Lt., N. 78° E., 24.3 miles.	6100	do	12.57 p. m.	268	gn. M
H. 6202	Cape Shoalwater Lt., N. 80½° E., 24.1 miles.	6100	do	1.19 p. m.	167	bl. Shl
H. 6203	Cape Shoalwater Lt., N. 83° E., 23.9 miles.	6100	do	1.38 p. m.	97	fne. gy. S
H. 6204	Cape Shoalwater Lt., N. 85° E., 23.8 miles.	6100	do	1.54 p. m.	87	do
H. 6205	Cape Shoalwater Lt., N. 86° E., 24.7 miles.	6100	do	2.11 p. m.	90	do
H. 6206	Cape Shoalwater Lt., N. 86½° E., 25.7 miles.	6100	do	2.26 p. m.	94	do
H. 6207	Cape Shoalwater Lt., N. 87° E., 26.7 miles.	6100	do	2.42 p. m.	136½	bl. M., fne. gy. S
H. 6208	Cape Shoalwater Lt., N. 88° E., 27.5 miles.	6100	do	2.59 p. m.	109	fne. gy. S
H. 6209	Cape Shoalwater Lt., N. 88½° E., 28.5 miles.	6100	do	3.16 p. m.	122½	fne. gn. S., gn. M., crs. bk. S.
H. 6210	Cape Shoalwater Lt., N. 89° E., 29.5 miles.	6100	do	3.32 p. m.	136½	fne. gn. S., crs. bk. S.
H. 6211	Cape Shoalwater Lt., N. 89½° E., 30.4 miles.	6100	do	3.49 p. m.	194	fne. gn. S

Investigations off Oregon-Washington Coasts, 1914 and 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
58	54				Luc. sdr.; 30-lb. lead.					
58	54				do					
58	54				Luc. sdr.; Sigs. rod.					
57	54				Luc. sdr.; 30-lb. lead.					
57	54				do					
61	54				do					
61	55				do					
61	55				Luc. sdr.; Sigs. rod.					
61	55				Luc. sdr.; 30-lb. lead.					
62	56				do					
62	56				do					
62	56				do					
62	56				Luc. sdr.; Sigs. rod.					
62	56				Luc. sdr.; 30-lb. lead.					
62	56				do					
63	56				do					
63	56				do					
63	56				Luc. sdr.; Sigs. rod.					
63	56				Luc. sdr.; 30-lb. lead.					
64	56				do					
64	55				El. sdr.; 30-lb. lead.					
63	56				do					
63	56				do					
63	56				do					
63	56				do					
63	56				do					
63	56				do					
66	56				do					
66	56				do					
66	56				do					
66	56				do					
68	56				do					
66	56				do					
65	56				do					
64	56				do					
64	56				do					
64	56				do					
64	56				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart. *C. S.*	Date. 1915.	Time of day.	Depth. *Fms.*	Character of bottom.
H. 6212	Cape Shoalwater Lt., N. 89½° E., 31.3 miles.	6100	Sept. 4	4.07 p. m.	219	fne. gy. S
H. 6213	Cape Shoalwater Lt., E., 32.3 miles.	6100	...do.....	4.26 p. m.	247	gn. M., gran. Shl
H. 6214	Cape Shoalwater Lt., S. 89½° E., 33.2 miles.	6100	...do.....	4.45 p. m.	$\frac{0}{300}$	
H. 6215	Cape Shoalwater Lt., S. 89¼° E., 32.2 miles.	6100	...do.....	5.11 p. m.	261	fne. gy. S
H. 6216	Cape Shoalwater Lt., S. 88½° E., 31.2 miles.	6100	...do.....	5.31 p. m.	202	gy. S., crs. S
H. 6217	Cape Shoalwater Lt., S. 87¾° E., 30.3 miles.	6100	...do.....	5.48 p. m.	149	fne. gn. S
H. 6218	Cape Shoalwater Lt., S. 87° E., 29.4 miles.	6100	...do.....	6.07 p. m.	111½	fne. bk. S
H. 6219	Cape Shoalwater Lt., S. 86¼° E., 28.5 miles.	6100	...do.....	6.23 p. m.	98	fne. gy. S
H. 6220	Cape Shoalwater Lt., S. 85° E., 27 miles.	6100	...do.....	6.39 p. m.	92	gn. M., fne. bk. S
H. 6221	Cape Shoalwater Lt., N. 77° E., 23.7 miles.	6100	...do.....	8.20 p. m.	143	fne. gy. S
H. 6222	Cape Shoalwater Lt., N. 73½° E., 23.1 miles.	6100	...do.....	8.42 p. m.	232	
H. 6223	Tillamook Head Lt., S. 49° E., 15.5 miles.	6100	Sept. 5	6.01 a. m.	68	fne. gy. S., gn. M
H. 6224	Tillamook Head Lt., S. 56½° E., 15.3 miles.	6100	...do.....	6.28 a. m.	72	.....do
H. 6225	Tillamook Head Lt., S. 65° E., 15.5 miles.	6100	...do.....	6.51 a. m.	77	.....do
H. 6226	Tillamook Head Lt., S. 72½° E., 15.8 miles.	6100	...do.....	7.10 a. m.	79	.....do
H. 6227	Tillamook Head Lt., S. 80° E., 16.5 miles.	6100	...do.....	7.28 a. m.	82	gn. M
H. 6228	Tillamook Head Lt., S. 87° E., 17.5 miles.	6100	...do.....	7.53 a. m.	82	.....do
H. 6229	Tillamook Head Lt., S. 82½° E., 17.2 miles.	6100	...do.....	8.13 a. m.	82	.....do
H. 6230	Tillamook Head Lt., S. 78° E., 16.9 miles.	6100	...do.....	8.28 a. m.	82	gn. M., fne. gy. S
H. 6231	Tillamook Head Lt., S. 72¾° E., 16.8 miles.	6100	...do.....	8.43 a. m.	81	.....do
H. 6232	Tillamook Head Lt., S. 68½° E., 16.8 miles.	6100	...do.....	8.58 a. m.	78	.....do
H. 6233	Tillamook Head Lt., S. 64° E., 16.9 miles.	6100	...do.....	9.14 a. m.	77	.....do
H. 6234	Tillamook Head Lt., S. 63½° E., 18 miles.	6100	...do.....	1.55 p. m.	72½	.....do
H. 6235	Tillamook Head Lt., S. 60¾° E., 18.4 miles.	6100	...do.....	2.16 p. m.	71	.....do
H. 6236	Tillamook Head Lt., S. 58¼° E., 18.8 miles.	6100	...do.....	2.30 p. m.	70½	.....do
H. 6237	Tillamook Head Lt., S. 55¾° E., 19.4 miles.	6100	...do.....	2.46 p. m.	69	.....do
H. 6238	Tillamook Head Lt., S. 53° E., 19.8 miles.	6100	...do.....	3.01 p. m.	68	fne. gy. S
H. 6239	Tillamook Head Lt., S. 59° E., 19.5 miles.	6100	...do.....	3.28 p. m.	70½	fne. gy. S., gn. M
H. 6240	Tillamook Head Lt., S. 61¾° E., 19.5 miles.	6100	...do.....	3.43 p. m.	72	.....do
H. 6241	Tillamook Head Lt., S. 64½° E., 19.5 miles.	6100	...do.....	3.57 p. m.	73	.....do
H. 6242	Tillamook Head Lt., S. 67¼° E., 19.5 miles.	6100	...do.....	4.10 p. m.	70	.....do
H. 6243	Tillamook Head Lt., S. 70° E., 19.6 miles.	6100	...do.....	4.24 p. m.	75	.....do
H. 6244	Tillamook Head Lt., S. 73° E., 19.7 miles.	6100	...do.....	4.37 p. m.	78	.....do
H. 6245	Tillamook Head Lt., S. 78° E., 20.2 miles.	6100	...do.....	5.01 p. m.	78	.....do
H. 6246	Tillamook Head Lt., S. 86° E., 21.2 miles.	6100	...do.....	5.35 p. m.	86	gn. M
H. 6247	Tillamook Head Lt., S. 81½° E., 21.9 miles.	6100	...do.....	6.10 p. m.	86	gn. M., fne. gy. S
H. 6248	Tillamook Head Lt., S. 77° E., 22.6 miles.	6100	...do.....	6.45 p. m.	84	

Investigations off Oregon-Washington Coasts, 1914 and 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
67	56				El. sdr.; 30-lb. lead.					
67	56				do.					
67	56				do.					
63	54				do.					
63	54				do.					
63	54				do.					
63	54				do.					
63	54				do.					
63	54				do.					
55	53				do.					
55	53				do.					
59	53				do.					
59	53				do.					
59	53				do.					
60	54				do.					
60	54				do.					
61	54				do.					
61	54				do.					
61	54				do.					
61	54				do.					
61	54				do.					
62	55				do.					
63	55				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
63	57				do.					
62	57				do.					
62	57				do.					Clean lead.

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 6249	Tillamook Head Lt., S. 75° E., 23 miles.	6100	Sept. 5	7.02 p. m.	84	gn. M., fne. gy. S..
H. 6250	Tillamook Head Lt., S. 73° E., 23.5 miles.	6100	...do.....	7.18 p. m.	87	.....do.............
H. 6251	Tillamook Head Lt., S. 71° E., 24.1 miles.	6100	...do.....	7.35 p. m.	81	.....do.............
H. 6252	Tillamook Head Lt., S. 67½° E., 25.2 miles.	6100	...do.....	8.03 p. m.	81	gran. shl...........
H. 6253	Tillamook Head Lt., S. 64° E., 26.3 miles.	6100	...do.....	8.31 p. m.	88	gn. M., fne. gy. S ..
H. 6254	Tillamook Head Lt., S. 61½° E., 27.5 miles.	6100	...do.....	9.00 p. m.	93	....
H. 6255	Tillamook Head Lt., S. 60° E., 28.1 miles.	6100	...do.....	9.18 p. m.	95	gn. M., fne. gy. S...
H. 6256	Tillamook Head Lt., S. 59° E., 28.7 miles.	6100	...do.....	9.36 p. m.	101	.....do.............
H. 6257	Tillamook Head Lt., S. 57½° E., 29.4 miles.	6100	...do.....	9.54 p. m.	224	.....do.............
H. 6258	Tillamook Head Lt., S. 55° E., 27.6 miles.	6100	...do.....	10.33 p. m.	$\frac{0}{285}$	....
H. 6259	Tillamook Head Lt., S. 52° E., 25.9 miles.	6100	...do.....	11.06 p. m.	98	bl. M., Sh.........
H. 6260	Tillamook Head Lt., S. 51° E., 25 miles.	6100	...do.....	11.23 p. m.	81	bl. shl.............
H. 6261	Tillamook Head Lt., S. 69° E., 26.5 miles.	6100	Sept. 6	7.26 a. m.	87	gn. M., fne. gy. S...
H. 6262	Tillamook Head Lt., S. 70° E., 27.4 miles.	6100	...do.....	7.42 a. m.	94	.....do.............
H. 6263	Tillamook Head Lt., S. 71½° E., 28.2 miles.	6100	...do.....	8.04 a. m.	106	bl. M., gran. Shl....
H. 6264	Tillamook Head Lt., S. 72½° E., 29 miles.	6100	...do.....	8.21 a. m.	119	gn. M., fne. gn. S...
H. 6265	Tillamook Head Lt., S. 74° E., 29.9 miles.	6100	...do.....	8.38 a. m.	130	gn. M., fne. gy. S...
H. 6266	Tillamook Head Lt., S. 75° E., 30.8 miles.	6100	...do.....	9.56 a. m.	186	.....do.............
H. 6267	Tillamook Head Lt., S. 77° E., 28.8 miles.	6100	...do.....	9.31 a. m.	118	.....do.............
H. 6268	Tillamook Head Lt., S. 77¾° E., 27.7 miles.	6100	...do.....	9.47 a. m.	110	.....do.............
H. 6269	Tillamook Head Lt., S. 78½° E., 26.8 miles.	6100	...do.....	10.03 a. m.	104	fne. gy. S..........
H. 6270	Tillamook Head Lt., S. 79½° E., 25.8 miles.	6100	...do.....	10.19 a. m.	98	gn. M., fne. bk. S...
H. 6271	Tillamook Head Lt., S. 80½° E., 24.9 miles.	6100	...do.....	10.35 a. m.	85	fne. bk. S., gran. Shl.
H. 6272	Tillamook Head Lt., S. 83° E., 26.4 miles.	6100	...do.....	11.06 a. m.	108	gn. M., fne. gy. S...
H. 6273	Tillamook Head Lt., S. 84½° E., 27.3 miles.	6100	...do.....	11.23 a. m.	114	.....do.............
H. 6274	Tillamook Head Lt., S. 85° E., 28.2 miles.	6100	...do.....	11.40 a. m.	128	....
H. 6275	Tillamook Head Lt., S. 86° E., 29 miles.	6100	...do.....	11.57 a. m.	214	gn. M..............
H. 6276	Tillamook Head Lt., S. 87½° E., 27.3 miles.	6100	...do.....	12.42 p.m.	117	gn. M., fne. bk. S..
H. 6277	Tillamook Head Lt., S. 88° E., 26.3 miles.	6100	...do.....	1.00 p.m.	111	.....do.............
H. 6278	Tillamook Head Lt., S. 88° E., 25.4 miles.	6100	...do.....	1.16 p.m.	86½	gran. Shl..........
H. 6279	Tillamook Head Lt., E., 26 miles.	6100	...do.....	1.39 p.m.	108	fne. gy. S., bl. M..
H. 6280	Tillamook Head Lt., N. 89° E., 26.8 miles.	6100	...do.....	1.57 p.m.	112	.....do.............
H. 6281	Tillamook Head Lt., N. 87½° E., 27.7 miles.	6100	...do.....	2.13 p.m.	119	gn. M., fne. bk. S..
H. 6282	Tillamook Head Lt., N. 86° E., 28.4 miles.	6100	...do.....	2.31 p.m.	134	gn. M., fne. gy. S..
H. 6283	Tillamook Head Lt., N. 85° E., 29.2 miles.	6100	...do.....	2.48 p.m.	173	.....do.............
H. 6284	Tillamook Head Lt., N. 84° E., 27.4 miles.	6100	...do.....	3.23 p.m.	113	fne. gy. S.........
H. 6285	Tillamook Head Lt., N. 83° E., 26.4 miles.	6100	...do.....	3.40 p.m.	104	fne. G.............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
60	56				El. sdr.; 30-lb. lead.					
60	56				do.					
60	56				do.					
60	55				do.					
60	55				do.					
59	54				do.					No sample.
59	54				do.					
59	54				do.					
56	53				do.					
56	53				do.					
56	53				do.					
....	....				do.					
59	52				do.					
59	52				do.					
60	53				do.					
60	53				do.					
60	53				do.					
62	54				do.					
62	54				do.					Chronometers were set back after sounding H. 6266 was made.
62	54				do.					
63	54				do.					
63	54				do.					
63	54				do.					
64	54				do.					
64	54				do.					
64	54				do.					Clean lead.
64	55				do.					
64	55				do.					
64	55				do.					
64	55				do.					
64	55				do.					
65	55				do.					
65	55				do.					
65	55				do.					
64	55				do.					
65	56				do.					
65	56				do.					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		Fms.	
H. 6286	Tillamook Head Lt., N. 82½° E., 25.4 miles.	6100	Sept. 6	3.56 p.m.	97	bl. M., fne. gn. S.
H. 6287	Tillamook Head Lt., N. 82° E., 24.4 miles.	6100	do	4.12 p.m.	94	gran. Shl., fne. gy. S.
H. 6288	Tillamook Head Lt., N. 81° E., 23.4 miles.	6100	do	4.29 p.m.	79	rky., G., S.
H. 6289	Tillamook Head Lt., N. 80° E., 25.8 miles.	6100	do	5.04 p.m.	97	fne. gy. S.
H. 6290	Tillamook Head Lt., N. 80° E., 26.8 miles.	6100	do	5.20 p.m.	104	
H. 6291	Tillamook Head Lt., N. 79½° E., 28 miles.	6100	do	5.37 p.m.	116	bl. M., fne. gy. S.
H. 6292	Tillamook Head Lt., N. 79° E., 29.1 miles.	6100	do	5.54 p.m.	132	fne. bk. S., gran. Shl.
H. 6293	Tillamook Head Lt., N. 79° E., 30.3 miles.	6100	do	6.11 p.m.	165	fne. bk. S., gn. M.
H. 6294	Tillamook Head Lt., N. 77° E., 28.5 miles.	6100	do	6.44 p.m.	125	fne. bk. S., gran. Shl.
H. 6295	Tillamook Head Lt., N. 76° E., 27.6 miles.	6100	do	7.02 p.m.	117½	fne. gy. S., gn. M., gran. Shl.
H. 6296	Tillamook Head Lt., N. 75° E., 26.6 miles.	6100	do	7.20 p.m.	104	gn. M., fne. gy. S.
H. 6297	Tillamook Head Lt., N. 73½° E., 25.6 miles.	6100	do	7.38 p.m.	94½	fne. bk. S.
H. 6298	Tillamook Head Lt., N. 72° E., 24.7 miles.	6100	do	7.56 p.m.	93	gy. M.
H. 6299	Tillamook Head Lt., N. 71° E., 23.8 miles.	6100	do	8.12 p.m.	94	gn. M., fne. gn. S.
H. 6300	Tillamook Head Lt., N. 69° E., 22.9 miles.	6100	do	8.32 p.m.	90	
H. 6301	Tillamook Head Lt., N. 67° E., 22 miles.	6100	do	8.49 p.m.	89	gn. M., fne. bk. S.
H. 6302	Tillamook Head Lt., N. 68½° E., 23.1 miles.	6100	Sept. 7	7.48 a. m.	98	do
H. 6303	Tillamook Head Lt., N. 68½° E., 24.2 miles.	6100	do	8.09 a. m.	96	fne. gn. S.
H. 6304	Tillamook Head Lt., N. 68½° E., 25.1 miles.	6100	do	8.25 a. m.	102	fne. bk. S.
H. 6305	Tillamook Head Lt., N. 68½° E., 26.2 miles.	6100	do	8.42 a. m.	118	gn. M.
H. 6306	Tillamook Head Lt., N. 68° E., 27.4 miles.	6100	do	8.58 a. m.	128	fne. bk. S.
H. 6307	Tillamook Head Lt., N. 68° E., 28.4 miles.	6100	do	9.15 a. m.	145	do
H. 6308	Tillamook Head Lt., N. 68° E., 29.4 miles.	6100	do	9.32 a. m.	175	gn. M., fne. gy. S.
H. 6309	Tillamook Head Lt., N. 66½° E., 28 miles.	6100	do	10.08 a. m.	130	fne. bk. S.
H. 6310	Tillamook Head Lt., N. 65½° E., 27.4 miles.	6100	do	10.27 a. m.	120	gn. M., fne. gn. S.
H. 6311	Tillamook Head Lt., N. 64½° E., 26.6 miles.	6100	do	10.44 a. m.	111	gn. M., fne. bk. S.
H. 6312	Tillamook Head Lt., N. 63½° E., 25.8 miles.	6100	do	11.01 a. m.	105	do
H. 6313	Tillamook Head Lt., N. 62½° E., 25.3 miles.	6100	do	11.18 a. m.	108	do
H. 6314	Tillamook Head Lt., N. 61° E., 24.5 miles.	6100	do	11.36 a. m.	103	gn. M.
H. 6315	Tillamook Head Lt., N. 60° E., 23.8 miles.	6100	do	11.52 a. m.	99	do
H. 6316	Tillamook Head Lt., N. 58½° E., 23.1 miles.	6100	do	12.09 p. m.	95	do
H. 6317	Tillamook Head Lt., N. 58½° E., 24.2 miles.	6100	do	12.42 p. m.	99	do
H. 6318	Tillamook Head Lt., N. 58½° E., 25.2 miles.	6100	do	12.58 p. m.	104	gn. M., fne. gy. S.
H. 6319	Tillamook Head Lt., N. 58½° E., 26.2 miles.	6100	do	1.14 p. m.	104	gn. M., fne. gn. S.
H. 6320	Tillamook Head Lt., N. 58½° E., 27.4 miles.	6100	do	1.30 p. m.	106	gn. M., fne. gy. S.
H. 6321	Tillamook Head Lt., N. 59° E., 28.3 miles.	6100	do	1.47 p. m.	111	fne. gy. S.
H. 6322	Tillamook Head Lt., N. 59° E., 29.5 miles.	6100	do	2.04 p. m.	117	fne. bk. S.
H. 6323	Tillamook Head Lt., N. 59° E., 30.5 miles.	6100	do	2.21 p. m.	128	gn. M., fne. bk. S.

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
65	56				El. sdr.; 30-lb. lead.					
66	56				do					
66	56				do					
66	56				do					
64	56				do					**Clean lead.**
64	56				do					
63	56				do					
63	56				do					
62	56				do					
62	56				do					
62	56				do					
62	56				do					
61	55				do					
61	55				do					
61	55				do					**Do.**
61	55				do					
					do					
56	53				do					
56	53				do					
56	53				do					
57	53				do					
57	53				do					
57	53				do					
57	53				do					
61	54				do					
61	54				do					
61	54				do					
63	54				do					
63	54				do					
63	54				do					
63	55				do					
63	55				do					
63	55				do					
63	55				do					
63	55				do					
63	55				do					
64	54				do					
64	54				do					

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 6324	Tillamook Head Lt., N. 59° E., 31.5 miles.	6100	Sept. 7	2.39 p. m.	142	gn. M., fne. bk. S..
H. 6325	Tillamook Head Lt., N. 59° E., 32.5 miles.	6100	...do.....	2.57 p. m.	159	....
H. 6326	Cape Meares Lt., S. 70° E., 28.3 miles.	6100	...do.....	3.35 p. m.	126	gn. M., fne. gy. S...
H. 6327	Cape Meares Lt., S. 69½° E., 27.2 miles.	6100	...do.....	3.53 p. m.	112	....
H. 6328	Cape Meares Lt., S. 69° E., 25.9 miles.	6100	...do.....	4.12 p. m.	109	fne. gy. S..........
H. 6329	Cape Meares Lt., S. 68° E., 24.5 miles.	6100	...do.....	4.29 p. m.	104	gn. M., fne. gy. S...
H. 6330	Cape Meares Lt., S. 67½° E., 23.2 miles.	6100	...do.....	4.45 p. m.	100	.....do............
H. 6331	Cape Meares Lt., S. 66½° E., 22.1 miles.	6100	...do.....	5.02 p. m.	90	small G...........
H. 6332	Cape Meares Lt., S. 65½° E., 20.7 miles.	6100	...do.....	5.18 p. m.	84	gn. M..............
H. 6333	Cape Meares Lt., S. 69° E., 22.1 miles.	6100	...do.....	6.00 p. m.	104	gn. M., fne. gy. S...
H. 6334	Cape Meares Lt., S. 71° E., 22.8 miles.	6100	...do.....	6.17 p. m.	109	....
H. 6335	Cape Meares Lt., S. 72½° E., 23.6 miles.	6100	...do.....	6.34 p. m.	115	gn. M., fne. gy. S...
H. 6336	Cape Meares Lt., S. 74½° E., 24.3 miles.	6100	...do.....	6.52 p.m.	122	.....do............
H. 6337	Cape Meares Lt., S. 76° E., 25 miles.	6100	...do.....	7.09 p.m.	133	fne. gn. S.........
H. 6338	Cape Meares Lt., S. 77° E., 25.8 miles.	6100	...do.....	7.28 p.m.	180	fne. gy. S.........
H. 6339	Cape Meares Lt., S. 77° E., 23.9 miles.	6100	...do.....	8.04 p.m.	126	.....do............
H. 6340	Cape Meares Lt., S. 77° E., 22.9 miles.	6100	...do.....	8.24 p.m.	115	fne. gy. S., gn. M..
H. 6341	Cape Meares Lt., S. 77° E., 21.9 miles.	6100	...do.....	8.42 p.m.	105	....
H. 6342	Cape Meares Lt., S. 77° E., 20.9 miles.	6100	...do.....	9.00 p.m.	100	gn. M., fne. gy. S..
H. 6343	Cape Meares Lt., S. 77° E., 19.9 miles.	6100	...do.....	9.18 p.m.	95	.....do............
H. 6344	Cape Meares Lt., S. 77° E., 17.9 miles.	6100	...do.....	....	91	gn. M..............
H. 6345	Cape Meares Lt., S. 84½° E., 17.4 miles.	6100	Sept. 8	7.28 a. m.	102	gn. M., fne. gy. S..
H. 6346	Cape Meares Lt., S. 85° E., 18.4 miles.	6100	...do.....	7.46 a. m.	105	fne. bn. S., bn. M.
H. 6347	Cape Meares Lt., S. 85½° E., 19.4 miles.	6100	...do.....	8.02 a. m.	109	gn. M., fne. gy. S..
H. 6348	Cape Meares Lt., S. 86° E., 20.4 miles.	6100	...do.....	8.17 a. m.	118	gy. S..............
H. 6349	Cape Meares Lt., S. 87° E., 21.4 miles.	6100	...do.....	8.34 a. m.	133	gn. M., fne. gy. S..
H. 6350	Cape Meares Lt., S. 87½° E., 22.4 miles.	6100	...do.....	8.51 a. m.	169	.....do............
H. 6351	Cape Meares Lt., E., 20.3 miles.	6100	...do.....	9.11 a. m.	144	gn. M., fne. gy. S..
H. 6352	Cape Meares Lt., N. 88° E., 19.2 miles.	6100	...do.....	9.27 a. m.	120	.....do............
H. 6353	Cape Meares Lt., N. 86° E., 18.2 miles.	6100	...do.....	9.43 a. m.	111	fne. gy. S.........
H. 6354	Cape Meares Lt., N. 84° E., 17.2 miles.	6100	...do.....	10.02 a. m.	104	....
H. 6355	Cape Meares Lt., N. 82° E., 16.2 miles.	6100	...do.....	10.18 a. m.	95	fne. gy. S., gn. M..
H. 6356	Cape Meares Lt., N. 79° E., 15.1 miles.	6100	...do.....	10.36 a. m.	94	.....do............
H. 6357	Cape Meares Lt., N. 77½° E., 16.3 miles.	6100	...do.....	11.01 a. m.	95	....
H. 6358	Cape Meares Lt., N. 75¾° E., 17.3 miles.	6100	...do.....	11.18 a. m.	105	fne. gy. S., gn. M..
H. 6359	Cape Meares Lt., N. 74° E., 18.3 miles.	6100	...do.....	11.35 a. m.	117	....
H. 6360	Cape Meares Lt., N. 72½° E., 19.4 miles.	6100	...do.....	11.53 a. m.	148	fne. gy. S.........
H. 6361	Cape Meares Lt., N. 68½° E., 17.9 miles.	6100	...do.....	12.29 p. m.	116	.....do............

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
64	54				El. sdr.; 30-lb. lead.					
63	54				do					Clean lead.
63	54				do					
63	54				do					Do.
62	54				do					
62	54				do					
62	54				do					
60	54				do					
61	54				do					
61	54				do					
61	54				do					Do.
61	54				do					
61	54				do					
61	55				do					
61	55				do					
62	53				do					
62	53				do					
62	53				do					Do.
62	53				do					
62	53				do					
					do					No time entered in yeoman's book.
60	53				do					
60	53				do					
58	53				do					
58	53				do					
58	53				do					
58	53				do					
59	53				do					
59	53				do					
59	53				do					
60	54				do					Clean lead.
60	54				do					
60	54				do					
60	54				do					Do.
63	55				do					
63	55				do					Do.
63	55				do					
65	56				do					

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING HALIBUT

Station number.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 6362	Cape Meares Lt., N. 66½° E., 17.3 miles.	6100	Sept. 8	12.44 p. m.	110	fne. gy. S., gn. M..
H. 6363	Cape Meares Lt., N. 64° E., 16.5 miles.	6100	...do.....	1.00 p. m.	100	.....do............
H. 6364	Cape Meares Lt., N. 61½° E., 15.9 miles.	6100	...do.....	1.15 p. m.	99	.....do............
H. 6365	Cape Meares Lt., N. 59° E., 15.3 miles.	6100	...do.....	1.30 p. m.	99	.....do............
H. 6366	Cape Meares Lt., N. 55½° E., 14.7 miles.	6100	...do.....	1.40 p. m.	97	.....do............
H. 6367	Hay Stack Rk., S. 64° E., 15.1 miles.	6000	...do.....	2.13 p. m.	105	.....do............
H. 6368	Hay Stack Rk., S. 68° E., 15.8 miles.	6000	...do.....	2.30 p. m.	109	.....do............
H. 6369	Hay Stack Rk., S. 71° E., 16.4 miles.	6000	...do.....	2.48 p. m.	133	gn. M.............
H. 6370	Hay Stack Rk., S. 73° E., 17.1 miles.	6000	...do.....	3.06 p. m.	175	fne. gy. S., gn. M..
H. 6371	Hay Stack Rk., S. 76° E., 18 miles.	6000	...do.....	3.25 p. m.	206	....
H. 6372	Hay Stack Rk., S. 77° E., 15.9 miles.	6000	...do.....	3.56 p. m.	147	gn. M., fne. bk. S...
H. 6373	Hay Stack Rk., S. 78° E., 14.9 miles.	6000	...do.....	4.13 p. m.	122	gn. S..............
H. 6374	Hay Stack Rk., S. 79° E., 13.9 miles.	6000	...do.....	4.28 p. m.	106	fne. gy. S..........
H. 6375	Hay Stack Rk., S. 80° E., 13 miles.	6000	...do.....	4.43 p. m.	99	fne. gy. S., gn. M...
H. 6376	Hay Stack Rk., S. 81° E., 12 miles.	6000	...do.....	4.58 p. m.	96	.....do............
H. 6377	Hay Stack Rk., S. 85½° E., 13.8 miles.	6000	...do.....	5.34 p. m.	115	....
H. 6378	Hay Stack Rk., S. 87¼° E., 14,7 miles.	6000	...do.....	5.49 p. m.	134	gn. M., fne. gy. S...
H. 6379	Hay Stack Rk., S. 89° E., 15.6 miles.	6000	...do.....	6.06 p. m.	200	gn. M.............
H. 6380	Hay Stack Rk., N. 86½° E., 13.9 miles.	6000	...do.....	6.39 p. m.	120	fne. gy. S., gn. M...
H. 6381	Hay Stack Rk., N. 83½° E., 13.1 miles.	6000	...do.....	6.54 p. m.	110	fne. gy. S..........
H. 6382	Hay Stack Rk., N. 80½° E., 12.4 miles.	6000	...do.....	7.08 p. m.	100	fne. gy. S., gn. M...
H. 6383	Hay Stack Rk., N. 76½° E., 11.5 miles.	6000	...do.....	7.23 p. m.	95	.....do............
H. 6384	Hay Stack Rk., N. 73½° E., 13.6 miles.	6000	...do.....	7.56 p. m.	115	....
H. 6385	Hay Stack Rk., N. 72½° E., 14.6 miles.	6000	...do.....	8.15 p. m.	135	....
H. 6386	Hay Stack Rk., N. 71½° E., 15.5 miles.	6000	...do.....	8.32 p. m.	175	fne. gy. S..........
H. 6387	Hay Stack Rk., N. 65° E., 14.6 miles.	6000	...do.....	9.04 p. m.	125	fne. gy. S., gn. M...
H. 6388	Hay Stack Rk., N. 61° E., 14.1 miles.	6000	...do.....	9.20 p. m.	111	fne. bk. S..........
H. 6389	Hay Stack Rk., N. 57½° E., 13.7 miles.	6000	...do.....	9.36 p. m.	102	fne. gy. S., gn. M...
H. 6390	Hay Stack Rk., N. 54° E., 13.3 miles.	6000	...do.....	9.51 p. m.	95	.....do............
H. 6391	Hay Stack Rk., N. 54½° E., 15.2 miles.	6000	...do.....	10.24 p. m.	109	.....do............
H. 6392	Hay Stack Rk., N. 54¾° E., 16.3 miles.	6000	...do.....	10.41 p. m.	120	.....do............
H. 6393	Hay Stack Rk., N. 55° E., 17.4 miles.	6000	...do.....	10.58 p. m.	135	.....do............
H. 6394	Hay Stack Rk., N. 55½° E., 18.4 miles.	6000	...do.....	11.15 p. m.	145	....
H. 6395	Hay Stack Rk., N. 49° E., 18.6 miles.	6000	...do.....	11.59 p. m.	120	gn. M., fne. gy. S...
H. 6396	Hay Stack Rk., N. 46° E., 18.9 miles.	6000	Sept. 9	12.16 a. m.	111	.....do............
H. 6397	Hay Stack Rk., N. 43° E., 19.2 miles.	6000	...do.....	12.31 a. m.	101	.....do............
H. 6398	Hay Stack Rk., N. 40° E., 19.5 miles.	6000	...do.....	12.47 a. m.	92	fne. bk. S..........
H. 6399	Yaquina Lt., S. 33° E., 19.6 miles.	6000	...do.....	1.20 a. m.	104	fne. gy. S., gn. M...

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
65	56				El. sdr.; 30-lb. lead.					
65	56				do.					
66	56				do.					
66	56				do.					
66	56				do.					
66	56				do.					
66	56				do.					
66	56				do.					
66	56				do.					
65	56				do.					Clean lead.
65	56				do.					
65	56				do.					
65	56				do.					
65	56				do.					
65	55				do.					
65	55				do.					Do.
65	55				do.					
64	54				do.					
64	54				do.					
64	54				do.					
60	54				do.					
60	54				do.					
60	54				do.					Do.
58	53				do.					Do.
58	53				do.					
58	53				do.					
57	53				do.					
57	53				do.					
57	53				do.					
57	53				do.					
57	53				do.					
57	53				do.					
59	53				do.					Do.
59	53				do.					
59	53				do.					
59	53				do.					
59	53				do.					
58	53				do.					

Dredging and Hydrographic Records Secured During Halibut

Station number	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
		C. S.	1915.		*Fms.*	
H. 6400	Yaquina Lt., S. 36° E., 20 miles.	6000	Sept. 9.	1.36 a. m.	112	fne. gy. S., gn. M..
H. 6401	Yaquina Lt., S. 38½° E., 20.2 miles.	6000	...do.....	1.53 a. m.	122	fne. gy. S..........
H. 6402	Yaquina Lt., S. 41° E., 20.5 miles.	6000	...do.....	2.10 a. m.	135	fne. gy. S., gn. M...
H. 6403	Yaquina Lt., S. 43½° E., 21 miles.	6000	...do.....	2.26 a. m.	150	.....do.............
H. 6404	Yaquina Lt., S. 45° E., 20.1 miles.	6000	...do.....	2.48 a. m.	133	.....do.............
H. 6405	Yaquina Lt., S. 46° E., 19.1 miles.	6000	...do.....	3.04 a. m.	115	.....do.............
H. 6406	Yaquina Lt., S. 47½° E., 18.1 miles.	6000	...do.....	3.19 a. m.	101	fne. gy. S..........
H. 6407	Yaquina Lt., S. 49° E., 17.1 miles.	6000	...do.....	3.34 a. m.	92	.....do.............
H. 6408	Yaquina Lt., S. 50½° E., 16.2 miles.	6000	...do.....	3.49 a. m.	88	fne. gy. S., gn. M...

Dredging and Hydrographic Records Secured During Atlantic Cruises,

Station number.	Bearings.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N., Longitude W.	*C. S.*	1919.		*Meters.*	
....	Cape Henry outer buoy......	....	Oct. 30	....	0	....
C20001	36 49 00 75 36 00	1001	...do.....	2.49 p. m. to 4.53 p. m.	19	S., Sh............
C20002	36 47 00 75 06 00	1001	...do.....	8.00 p. m. to 9.20 p. m.	31	.....do...........
C20003	36 45 00 74 41 30	1001	Oct. 31	12.01 a. m. to 1.30 a. m.	73	.....do...........
C20004	36 41 00 74 34 30	1001	...do.....	3.00 a. m. to 6.00 a. m.	336	gn. S., M ....

[a] Surface temperatures taken while the *Albatross* was under way during the Atlantic cruises are given in the table on page 174.

INVESTIGATIONS OFF OREGON-WASHINGTON COASTS, 1914 AND 1915—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Surf.	Botm.	Surf.	Botm.		Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.					Min.		Mi.	
58	53				El. sdr.; 30-lb. lead.					
58	53				do					
58	53				do					
58	53				do					
58	53				do					
58	53				do					
58	53				do					
58	53				do					
58	53				do					

SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920.[a]

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
			0	26.51						
21.11	0 6 14	19.40 19.63 19.58	0 7 14	31.07 31.08 31.09	Hvg. ln.; snap. ld.; GB bot.; NZ; R; Tycos.					
					botm. net	botm.–0	30			Cable out (botm. net) 100 meters, angle 60°.
					mtr. net	5–0	30			Cable (mtr. net) out 63 meters., angle 60°.
					#10, #20	0	20			#10 out 5 min.
					35′ shr. trl	(?)	15			Cable (35′ shr. trl.) out 306 meters; did not reach bottom.
19.44	0 15 30	20.80 17.21 16.23	0 15 30	31.92 31.98 32.59	Hvg. ln.; snap. ld.; GB bot.; NZ; R; Tycos.					
					vert. net	30–0				
					botm. net	30–0	30			
					#10, #20	0	25			
19.44	0 10 30 60 90	12.80 17.82 16.53 9.96 10.93	0 10 30 60 90	33.62 33.57 33.78 33.10 34.02	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.					El. sdr. dial read 40 fms., but bottles were sent down to 90 meters.
					vert. net	90–0				
					botm. net	75–0	30			Cable (botm. net) out 100 meters.
					#10, #20	0	20			
19.44	0 10 50 100 150 200 300	17.80 17.87 10.89 11.26 11.99 11.15 7.63	0 10 50 100 150 200 300	33.60 33.65 33.12 34.25 35.39 35.35 35.07	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.					
					vert. net. and m. b.	200–0				
					botm. net	200–0	30			
					#10, #20	0	30			

Dredging and Hydrographic Records Secured During Atlantic Cruises,

Station number.	Bearings.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N., Longitude W.	*C. S.*	1919.		*Meters.*	
C20005	From 36 35 30 74 23 30 To 36 31 00 74 28 00 and From 36 37 30 74 21 30 To 36 35 30 74 23 30	1001	Oct. 31	7.30 a. m. to 5.30 p. m.	2,029	gn. S., M.
C20006	35 04 00 75 18 00	1001	Nov. 1	10.15 a. m. to 11.10 a. m.	36	S., Sh.
C20007	35 01 00 75 14 00	1001	...do...	1.00 p. m. to 3.00 p. m.	223	P., S., Sh.
20008	From 34 54 30 75 07 00 To 34 59 00 75 02 00	1001	...do...	7.35 p. m. to 10.50 p. m.	1,890	
	Cape Canaveral Anchorage		Nov. ?		0	
	St. John's Bay, "Brown water."		Nov. 9		0	
	St. John's Bay, "Brown water" (outside).		...do...		0	
	Mayport, Fla.		...do...		0	
20009	From 29 55 30 81 10 00	1007	...do...	5.25 p. m. to 5.40 p. m.	17	S., Sh.
20010	27 34 00 80 10 00	1007	Nov. 10	1.38 p. m. to 1.55 p. m.	18	...do...
C20011	From 27 34 00 79 55 30 To 27 37 00 79 56 30	1007	...do...	3.30 p. m. to 4.20 p. m.	85	...do...

SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
21.67	0	19.40	0	34.20	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	...	...	S. 38 W...	6.0	7.30 a. m. to noon, 1 to 5.30 p. m.; drift. Very stiff northwest wind. At noon ran to northwestward of beginning position to drift down to it.
	50	14.75	50	34.13				S. 38 W	2.5	
	100	13.98	100	35.58						
	200	10.18	200	34.99						
	400	5.79	400	34.97						
	600	4.55	600	34.99						
	1,000	3.94	1,000	34.95						
	1,400	3.46	1,400	34.96						
	1,800	3.37	1,800	34.91						
					vert. net	400-0	9	...	...	
					botm. net	200-0	30	...	...	
					mtr. net	100-0	30	...	...	
					#10, #20	0	25	...	...	
25.56	0	24.40	0	34.28	El. sdr.; NZ; R; Tycos; snap. ld.; GB bot.	...	...	...	...	
	15	24.25	15	34.74						
	30	24.72	30	35.33						
					botm. net	25-0	30	...	...	Cable (botm. net) out 40 meters.
					#10, #20	0	25	...	...	
27.0	0	27.80	0	36.03	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	...	...	...	...	Temp. at 50 meters may have been 0.5 higher; almost too high for therm.
	50	27.50	50	35.98						
	100	26.85	100	35.99						
	150	24.85	150	36.02						
	200	16.16	200	35.95						
					mtr. net	200-0	...	...	...	Mtr. net used for vertical haul.
					botm. net	190-0	25	...	...	Cable (botm. net) out 220 meters.
					#10, #20	0	25	...	...	
26.11	0	26.70	...	...	Luc. sdr.; Sigs. rod.; GB bot.; NZ; R; SV; Tycos.	...	...	N. 45 E...	6.2	Sample for salinity at 0 meters lost. During soundings, with 1,060 fms. wire out, wire parted, and carried away with Sigs. rod. Sea so choppy that bottles were sent down to only 1,000 meters; no nets used. Wire with bottles at 400, 600, 800, and 1,000 meters at angle 40°.
	50	26.45	50	35.98						
	100	25.58	100	36.02						
	150	26.39	150	36.13						
	200	18.03	200	35.99						
		23.86								
		23.04								
	400	16.44	400	35.97						
	600	12.90	600	35.62						
	800	11.76	800	35.47						
	1,000	8.85	1,000	35.10						
		8.61								
...	...	...	0	35.32	...	...	...	...	...	
...	0	41.67	0	34.51	...	...	...	...	...	Ebb tide.
...	...	...	0	34.53	...	...	...	...	...	Do.
...	...	...	0	34.27	...	...	...	...	...	Do.
22.2	0	25.30	0	35.26	Hvg. ln.; snap. ld.; GB bot.; R.; SV; Tycos.	...	...	...	...	
	14	24.59	14	35.26						
25.5	0	25.30	0	35.98	Hvg. ln.; snap. ld.; GB bot.; R.; SV; Tycos.	...	...	...	...	
	16	24.81	16	35.96						
26.11	0	26.90	0	35.99	El. sdr.; snap. ld.; GB bot.; NZ; R.; SV; Tycos.	...	...	N. 21 W...	4	Wire with bottles, angle 15°
	14	26.17	14	35.95						
	34	26.17	34	35.95						
	54	25.91	54	35.95						
	74	25.67	74	35.97						
					vert. net	45-0	...	...	...	
					m. b.	botm.	...	...	...	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N., Longitude W.	*C. S.*	1919.		*Meters.*	
C20012	From 27 34 00 79 34 00 To 27 41 30 79 36 00	1007	Nov. 10	7.00 p.m. to 9.00 p.m.	432	gy. M., S..........
....	St. John's River, halfway between Halifax and the sea.	....	Nov. 11	....	0	....
20013	From 27 34 00 79 10 00 To 27 37 30 79 11 00	1007	...do.....	12.23 a.m. to 1.55 a.m.	(?)	S., Sh.............
20014	From 25 34 30 80 04 00	1007	...do.....	7.18 p.m. to 7.40 p.m.	100	.....do............
C20015	From 25 34 00 79 57 30 To 25 36 00 79 57 30	1007	...do.....	8.05 p.m. to 9.55 p.m.	322	gy. M., S..........
C20016	From 25 34 00 79 45 30 To 25 40 30 79 45 30	1007	Nov. 12	12.12 a.m. to 2.51 a.m.	822	gy. M.............
C20017	From 25 33 30 79 27 30 To 25 37 00 79 27 30	1007	...do.....	5.18 a.m. to 7.46 a.m.	877	Co., S., Sh........
C20018	24 25 00 81 55 00	1007	Nov. 15	6.18 p.m. to 7.52 p.m.	117	S., Sh.............

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
26.11	0	27.75	0	35.84	Luc. sdr.; Sigs. rod; GB bot.; NZ; R.; SV; Tycos.			N. 14½ W.	7.5	Wire with bottles, angle 25°.
	50	27.24	50	35.85						
	100	24.32	100	36.11						
	150	20.62	150	36.36						
	200	17.73	200	36.26	vert. net	250–0				On heaving in vert. net, a sudden lurch of the ship sharply jerked the wire, causing the bridle to part at the thimble; net, ring, and sinker were lost.
	250	16.20								
	300	15.20	300	35.99						
	350	11.74	350	35.46						
	400	8.60	400	35.06						
			0	30.72						High water.
25.0	0	27.75	0	36.00	Luc. sdr.; Sigs. rod; GB bot.; NZ; R.; SV; Tycos.			N. 15½ W.	4	Recorded depth (418 fms.) is incorrect. Wire tended far astern and depth shown on chart is 200 to 300 fms.
	20	27.36	20	35.95						
	60	27.37	60	35.98						
	100	26.44	100	36.24						
	150	27.24	150	36.67						
	200	19.79	200	36.63						
	250	17.78	250	36.41						
	300	17.11	300	36.24						
	350	16.19	350	36.13						
24.44	0	26.90	0	35.90	El. sdr.; snap. ld.; GB bot.; NZ; R.; SV; Tycos.					
	30	26.35	30	35.90						
	60	26.43	60	35.95						
	90	24.59								
24.44	0	26.70	0	35.90	Luc. sdr.; Sigs. rod; GB bot.; NZ; R.; SV; Tycos.			N	2	
	50	26.32	50	35.90						
	100	22.51	100	36.24						
	150	16.33	150	35.95						
	200	10.18	200	35.28	vert. net	240–0				
	250	9.13	250	35.10	botm. net	botm.–0	30			
		8.97			#10, #20	0	25			
	300	8.08								
23.33	0	27.75	0	35.88	Luc. sdr; Sigs. rod; GB bot.; NZ; R; SV; Tycos.			N	6.5	
	50	27.25	50	35.84						
	100	25.87	100	36.33						
	150	21.06	150	36.64						
	200	17.88	200	36.39	vert. net	800–0				Vert. net fouled in bridle.
	300	14.65	300	36.00						
	400	11.59	400	35.43	botm. net	550–0	30			Cable out (botm. net) 700 meters.
	600	6.99	600	34.87						
	800	5.88	800	34.86	mtr. net	175–0	30			Cable out (mtr. net) 200 meters.
					#10, #20	0	25			
25.0	0	28.10	0	36.04	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.			N	3.3	
	50	27.24	Samp	le lost						
	100	27.00	100	36.11						
	150	23.25	150	36.63						
	195	20.33	195	36.64	vert. net	800–0				
	300	17.33	300	36.32	botm. net	700–0	30			Cable out (botm. net) 800 meters.
	400	14.52	400	35.84						
	600	9.28	600	35.05	mtr. net	200–0	30			Cable out (mtr. net) 300 meters.
	800	6.93	800	34.85						
					#10, #20	0	25			
28.5	0	26.90	0	35.99	El. sdr.; snap ld.; GB bot.; NZ; R; SV; Tycos.					
	30	26.26	30	35.95						
	60	25.95	60	35.95						
	90	20.95	90	36.27	vert. net	100–0	30			
	100	19.26	100	36.26	botm. net	100–0				Cable out (botm. net) 120 meters.
					#10, #20	0	25			

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N., Longitude W.	*C. S.*	1919.		*Meters.*	
C20019	From 24 10 30 82 00 00 To 24 07 30 81 58 00	1007	Nov. 15–16	9.42 p. m. to 12.53 a. m.	656	gy. M
C20020	From 23 58 30 81 59 00 To 23 56 30 81 57 00	1007	Nov. 16	2.00 a. m. to 5.08 a. m.	996	do
C20021	From 23 42 30 82 09 30 To 23 38 00 82 08 00	1007	Nov. 16	7.08 a. m. to 10.27 a. m.	1,645	gy. M., pter. Oz
20022	From 23 30 00 82 14 00 To 23 28 00 82 12 30	1007	do	11.45 a. m. to 1.49 p. m.	1,681	do
C20023	From 23 14 00 82 14 00 To 23 13 30 82 27 00	1007	Nov. 21	9.35 a. m. to 1.41 p. m.	1,270	gy. M
C20024	From 21 50 00 85 08 00 To 21 52 00 85 09 30	1007	Nov. 22	1.06 p. m. to 6.10 p. m.	1,664	co. S

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
24.44	0	26.70	0	35.90	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	....	......	S. 20 E....	3¼	
	50	25.88	50	35.90						
	100	20.45	100	36.29						
	150	16.63	150	36.13						
	200	13.36	200	35.70	vert. net........	600–0	......	....	.....	
	300	11.04	300	35.34	botm. net........	600–0	60	....	.....	Cable out (botm. net) 600 meters.
	400	10.33	400	35.21						
	500	8.83	500	35.03	mtr. net........	200–0	40	....	.....	Cable out (mtr. net) 200 meters.
	600	7.56	600	34.88						
					#10, #20........	0	25	....	.....	
25.0	0	27.50	0	35.84	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	....	......	S. 46 E....	2.5	Wire with bottles at 400, 500, 700, and 950 meters at angle 20°.
	50	27.30	50	35.87						
	100	22.96	100	36.26						
	200	14.98	200	36.27						
	300	11.16	300	35.39	botm. net........	900–0	60	....	.....	Cable out (botm. net) 1,000 meters.
	400	9.76	400	35.38						
	500	9.06	500	35.04						
	700	6.94	700	34.87	mtr. net........	200–0	60	....	.....	Cable out (mtr. net) 300 meters.
	950	5.69	950	34.84						
					#10, #20........	0	60	....	.....	
25.0	0	28.10	0	36.04	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	....	......	S. 19½ E...	5	Temp. at 50 m. probably not more than 0.2 higher; top of mercury could not be seen.
	50	27.53	50	36.04						
	100	26.54	100	36.22						
	200	18.83	200	36.51						
	300	15.11	300	35.96						
	400	11.10	400	35.34						
	600	8.19	......	......	vert. net........	500–0	......	....	.....	
	800	6.39	800	34.96	botm. net........	400–0	30	....	.....	Cable out (botm. net) 600 meters.
	1,000	5.77	1,000	34.85						
	1,300	5.30	1,300	34.87	mtr. net........	200–0	30	....	.....	Cable out (mtr. net) 300 meters.
	1,600	4.27	1,600	34.96						
					#20.............	0	25	....	.....	
					#10.............	0	20	....	.....	
27.0	0	28.60	0	36.06	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	....	......	S. 37½ E...	2.5	Temp. reading at 50 meters probably correct; graduation of therm. runs to 27.4; the 0.03 was estimated.
	50	27.43	50	36.11						
	100	26.46	100	36.20						
	200	20.32	200	36.62						
	300	16.13	300	36.12						
	400	12.49	400	35.54						
	600	8.42	600	35.08						
	800	6.27	800	34.87						
	1,000	5.46	1,000	34.87						
	1,300	4.83	1,300	34.94						
	1,600	4.25	1,600	34.96						
26.67	0	27.75	0	36.08	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	....	......	S. 88 W...	12	Wire with bottles at 400, 600, 900, and 1,200 m., had angle 40°-45°.
	50	27.12	50	36.08						
	100	26.70	100	36.16						
	200	23.59	200	36.69						
	300	18.94	300	36.42	vert. net........	600–0	......	....	.....	
	400	17.10	400	36.29	botm. net; mtr. net.	1,100–0	30	....	.....	Cable (botm. and mtr. net) out 1,300 meters. Clamp holding mtr. net at intermediate depth slid down wire to botm. net.
	600	11.67	600	35.48						
	900	6.74	900	34.96						
	1,200	5.07	1,200	36.33						
					#10, #20........	0	30	....	.....	
26.11	0	27.50	0	36.08	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.	....	......	N. 32 W...	2.5	Wire with bottles at 800, 1,000, 1,300, and 1,600 meters had angle 15°.
	50	27.28	50	36.04						
	100	27.28	100	36.02						
	200	21.07	200	36.73						
	300	17.70	300	36.39						
	400	15.61	400	36.05	9′ Tnr.; m. b ...	botm.	......	....	.....	Cable out (9′ Tnr. m. b.) 2,743 meters; fouled 20 mtr. above bridle, causing delay of 15 min. in hauling. When net was brought in the m. b. was found in it.
	600	10.92	600	35.31						
	800	7.77	......	......						
	1,000	4.82	1,000	34.95						
	1,300	4.20	1,300	34.92						
	1,600	4.11	1,600	34.94						

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N., Longitude W.	*C. S.*	1919.		*Meters.*	
C20025	From 21 44 30 85 39 00 To 21 47 30 85 44 00	1007	Nov. 22-23.	9.45 p. m. to 1.55 a. m.	1,600	....
C20026	From 21 31 00 86 08 30 To 21 41 00 86 10 00	1007	Nov. 23	5.32 a. m. to 10.20 a. m.	1,745	....
C20027	From 21 35 30 86 35 00 To 21 42 30 86 37 00	1007	...do.....	2.00 p. m. to 4.05 p. m.	36	Co., St............
C20028	From 23 47 30 84 23 00 To 23 43 00 84 16 00	1007	Nov. 24	3.27 p. m. to 8.05 p. m.	2,842	rd. C.............
C20029	From 24 24 00 83 18 00 To 24 22 00 83 16 00	1007	Nov. 25	7.00 a. m. to 8.40 a. m.	176	wh. M............

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			Mtrs.	Min.		Mi.	
26.11	0	28.10	0	36.04	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.			N. 56 W.	6	On beginning to sound wire parted at old splice, carrying away Sigs. rod. No further attempt was made to sound, since deep water was indicated on chart. Wire with bottles at 800, 1,000, 1,300, and 1,600 meters had angle 15°.
	50	27.42	50	36.07						
	100	27.39	100	36.07						
	200	20.58	200	36.65						
	300	18.00	300	36.40						
	400	15.51	400	36.00						
	600	10.21	600	35.25						
	800	7.12	800	34.86						
	1,000	5.33	1,000	34.88						
	1,300	4.32	1,300	34.93						
	1,600	4.15	1,600	35.08						
					vert. net	500-0				
					mtr. net	1,600-0.	30			
					#10, #20	0	30			Bridle of #20 parted, net carried away.
24.44	0	28.10	0	36.01	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV; Tycos.			N. 7½ W.	10.5	While heaving in sounding wire, with 20 fms. out, a sea carried wire into propeller, and Sigs. rod was lost. Wire with bottles at 800, 1,000, 1,300, and 1,600 meters had angle 20°. Stray of the wire indicated current was at depth of 300 meters.
	50	27.33	50	35.99						
	100	25.18	100	36.47						
	200	18.80	200	36.48						
	300	17.30	300	36.26						
	400	15.07	400	35.97						
	600	11.53	600	35.40						
	800	7.08	800	34.82						
	1,000	6.09	1,000	34.83						
	1,300	4.47	1,300	34.97						
	1,600	4.23	1,600	34.95						
					vert. net	500-0				
					botm. net	botm.-0	30			Cable out (botm. net) 1,400 meters.
					mtr. net	200-0	30			Cable out (mtr. net) 400 meters.
					#10, #20	0	45			
28.5	0	27.75	0	35.97	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.			N. 10 W.	7.5	
	15	27.10	15	35.93						
	30	26.92	30	35.90						
					botm. net	25-0	30			Cable out (botm. net) 40 meters.
					#10, #20	0	30			
					9′ Tnr	botm.	18			Cable out (9′ Tnr.) 360 meters.
27.0	0	28.10	0	36.08	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; SV.; Tycos.			S. 53 E.	7.5	Wire with bottles at 200, 300, 400, and 600 meters, had angle 20°.
	50	27.17	50	36.06						
	100	27.18	100	36.09						
	200	22.08	200	36.74						
	300	17.61	300	36.32	vert. net	500-0				
	400	14.76	400	35.88	botm. net	1,700-0	30			Cable out (botm. net) 1,800 meters.
	600	9.52	600	35.08						
	900	6.21	900	34.85						
	1,200	5.15	1,200	34.90	mtr. net	200-0	30			Cable out (mtr. net) 300 meters.
	1.500	4.35	1,500	34.96						
	1,800	4.19	1,800	34.97	#10, #20	0	35			
24.44	0	26.70	0	36.05	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.			S. 38 E.	2¼	
	50	25.83	50	36.04						
	100	20.02	100	36.47						
	150	15.75	150	36.07	vert net	150-0				
					botm. net	150-0	30			Cable out (botm. net) 200 meters.
					mtr. net	50-0	30			Cable out (mtr. net) 100 meters.
					#10, #20	0	35			

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES.

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*C. S.*	1919.		*Meters.*	
C20030	From 24 25 00 To 24 23 00	82 58 00 82 57 00	1007	Nov. 26	4.00 p. m. to 5.40 p. m.	87	wh. M.
C20031	24 23 00	82 21 00	1007	do.	10.00 p. m. to 11.23 p. m.	72	do.
C20032	24 24 30	81 33 30	1007	Dec. 4	9.30 a. m. to 11.30 a. m.		bn. M.
C20033				Dec. 5			
C20034	30 46 00	81 20 00	1007	Dec. 8	11.50 a. m. to 12.47 p. m.	13	bk. M.
C20035	From 32 10 00 To 32 11 00	79 07 00 79 04 00	1001	Dec. 9	7.50 a. m. to 1.30 p. m.	214	gn. M., S.
C20036	33 51 00	78 05 00	1001	Dec. 10	8.30 a. m. to 10.30 a. m.[a]	10	
C20037	From 33 34 00 To 33 41 00	76 41 00 76 41 00	1001	Dec. 12	5.55 p. m. to 9.05 p. m.	210	S., Sh.
C20038	34 34 30	76 36 30	1001	Dec. 13	8.45 a. m.	16	
C20039	From 34 25 00 To 34 47 30	75 45 30 75 17 30	1001	do.	5.45 p. m. to 11.10 p. m.	316	

[a] Time approximate.

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Water.									
	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	*Mtrs.*	*°C.*	*Mtrs.*			*Mtrs.*	*Min.*		*Mi.*	
......	......	......	......	......	El. sdr.; snap. ld.; 9′ Tnr., m. b.	botm.	45	S. 35 E.	2.5	Cable out (9′ Tnr.) 300 fms. (540 meters). One side of frame parted, whole frame crumpled; brought up about 3 cu. ft. white mud.
26.11	0 10 30 60	26.40 25.91 25.86 24.22	0 10 30 60	36.04 36.02 36.02 36.18	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	......	......	......	......	
					vert. net	60-0	......	......	......	
					botm. net	50-0	30	......	......	Cable out (botm. net) 60 meters.
					mtr. net	20-0	30	......	......	Cable out (mtr. net) 30 meters.
					#10, #20	0	30	......	......	
......	......	......	......	......	35′ shr. trl	botm.	......	......	......	Two hauls with trawl towed by motor launch in bight below Cape Canaveral, Fla.
......	......	......	......	......	do	do				Fernandina Harbor, Fla., afternoon.
23.33	0 10	17.78 18.42	0 10	33.90 34.04	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	......	......	......	......	
					botm. net	botm.-0	30	......	......	Cable out (botm. net) 30 meters.
					#10, #20	0	30	......	......	
23.89	0 50 100 150 200	22.70 22.46 15.56 14.28 13.21	0 50 100 150 200	36.13 36.09 36.00 35.85 35.69	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	......	......	Tow; N. 24 W.	6.5	
					5′ Tnr	botm.	25	......	......	Cable out (5′ Tnr.) 300 fms. (540 meters).
					75′ fldr	botm.	120	......	......	Cable out (75′ fldr.) 325 fms. (585 meters).
					#10, #20	0	45	......	......	
23.33	0 10	15.30 14.49	0 10	35.19 35.23	GB bot.; NZ; R; Tycos.	......	......	Anchored.	......	Temps. at ship's anchorage.
					35′ shr. trl	......	......	......	......	Trawl towed from motor boat during morning.
23.33	0	21.90	0	36.31	El. sdr.; snap. ld.; Tycos.	......	......	Tow; N.	6.7	
					75′ fldr	botm.	105	......	......	Cable out (75′ fldr.) 325 fms. (585 meters).
20.56	0 15	14.10 13.23	0 15	32.52 32.76	GB bot.; NZ; R; Tycos.	......	......	Anchored.	......	Temps. taken at ship's anchorage.
					35′ shr. trl	......	......	......	......	Trawl towed from motor boat during morning.
21.67	0 50 100 175 250	25.00 24.45 23.19 19.02 12.17	0 50 100 175 250	36.26 36.28 36.44 36.48 35.50	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	......	......	Tow and drift; N. 46 E.	31.3	Wire with bottles had angle 15°.
					75′ fldr	2,00?-0.	120	......	......	Trawl showed no sign of having been on bottom; sounding at 10.30 p. m. gave 600 fms. Supposition is that first sdg. was incorrect. Cable out 325 fms. with trawl.
					# 10, #20	0	45	......	......	#20 net fouled in cable carried away.

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES.

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*C. S.*	1919.		*Meters.*	
C20040	35 16 30	75 25 00	1001	Dec. 14	9.10 a. m.	19	gy. S., M.
			H. O.	1920.			
C20041	From 37 50 00 To 37 60 00	74 06 30 74 02 00	1411	Feb. 20	2.35 a. m. to 7.12 a. m.	165	
C20042	From 39 00 00 To 39 01 00	72 56 30 72 49 30	1411	Feb. 20-21	9.35 p. m. to 1.00 a. m.	202	Sh.
C20043	From 39 36 00 To 39 34 00	72 04 30 72 00 00	1411	Feb. 21	7.18 a. m. to 10.55 a. m.	200	
C20044	40 07 00	68 03 00	1411	Feb. 22	12.25 p. m. to 5.00 p. m.	1,828	gy. M.
C20045	40 18 00	68 09 00	1411	...do...	5.45 p. m. to 7.45 p. m.	155	Sh.
C20046	40 37 30	68 20 30	1411	...do...	10.20 p. m. to 11.40 p. m.	80	
C20047	41 08 00	68 34 30	1411	Feb. 23	4.25 a. m. to 5.45 a. m.	54	S., Sh.

SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	*Mtrs.*	°C.	*Mtrs.*			*Mtrs.*	*Min.*		*Mi.*	
18.89	0	12.80	18	32.21	GB bot.; NZ; R; Tycos.	....	....	Anchored.	.....	Temp. at anchorage.
	18	13.24	......	......						
0.0	0	3.05	......	......	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	....	....	Tow; S. 88 E.	4	
	20	5.52	20	33.12						
	50	8.34	50	34.05						
	100	9.05	100	34.36	80′ fldr.	botm.	120	....	.....	275 fms. cable out.
	150	10.20	150	34.72	#20, #6.	0.	60	....	.....	#6 badly torn by wind.
2.78	0	5.56	0	None.	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	....	....	....	.....	
	50	6.12	20	33.45				Tow; N. 80 E.	6	
	20	6.37	50	33.55						
	100	9.47	100	34.43	80′ cod.	botm.	60	....	.....	Ring on port board of trawl carried away; no catch; 275 fms. cable out.
	150	10.60	150	35.16	#6, #20.					
	200	8.87	200	33.64						
4.44	0	5.56	......	......	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	....	....	Tow; S. 55 E.	4	
	20	5.61	20	33.12						
	50	8.50	50	34.20						
	100	11.45	100	35.05	80′ cod.	botm.	120	....	.....	
	150	11.35	150	35.30	#6, #20.	0.	30	....	.....	
	200	9.87	200	35.21						
9.44	0	4.44	......	......	Luc. sdr.; Sigs. rod; GB bot.; NZ; R; Tycos.	....	....	....	.....	On 1st sdg. wire parted; 330 fms. wire and sdg. rod carried away. Wire bottles at 500, 1,000, 1,400, and 1,800 mtrs., angle 55°, with bottles at 50, 100, 200, and 300, angle 45°.
	50	9.76	50	34.45						
	100	12.39	100	35.18						
	200	12.39	200	35.27						
	300	10.91	300	35.32						
	500	7.24	500	35.00						
	1,000	4.21	1,000	34.90						
	1,400	3.92	1,400	34.92						
	1,800	3.62	1,800	34.90						
					vert. net	1,200-0.	....	....	.....	
					botm. net	600-0.	30	....	.....	
					mtr. net	100-0.	30	....	.....	
					#6, #20.	0.	30	....	.....	
9.44	0	5.00	0	32.34	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	....	....	....	.....	
	20	4.59	20	32.92						
	50	9.40	50	34.42						
	100	12.35	100	35.34	vert. net	150-0.	....	....	.....	
	150	11.55	150	35.25	botm. net	....	30	....	.....	
					mtr. net	....	30	....	.....	
					#6, #20.	0.	30	....	.....	
3.89	0	5.00	0	32.34	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.	....	....	....	.....	
	10	3.37	10	32.38						
	40	4.50	40	32.77						
	50	7.11	50	33.76	vert. net	50-0.	....	....	.....	
	70	8.03	70	32.63	botm. net	60-0.	30	....	.....	Cable out (botm. net) 100 meters.
					#6, #20.	0.	30	....	.....	
2.78	0	4.44	0	32.39	El. sdr.; snap. ld.; Tycos; GB bot.	....	....	....	.....	At this and all succeeding stations in Gulf of Maine and on route to Baltimore sounded with sinker at end of ¼″ wire (st'b'd. winch). Therms. were inadvertently reversed (by whom could not be ascertained) before readings were recorded.
	......	......	20	32.38						
	......	......	50	32.47						
					vert. net	50-0.	....	....	.....	
					botm. net	botm.	30	....	.....	Botm. net full of sand.
					#6, #20.	0.	30	....	.....	

Dredging and Hydrographic Records Secured During Atlantic Cruises,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*H. O.*	1920.		*Meters.*	
C20048	41 41 00	68 49 00	1411	Feb. 23	10.45 a. m. to 12.35 p. m.	170	gy. M.
C20049	42 30 00	69 34 30	1411	...do.....	10.00 p. m. to 11.45 p. m.	242	.....do.
C20050	42 30 00	70 18 00	941	Mar. 1	2.33 p. m. to 4.20 p. m.	176	
C20051	42 30 30	70 08 30	941	Mar. 1–2	7.00 p. m. to 7.30 a. m.	79	
					7.15 p. m.		
					7.45 p. m.		
					8.20 p. m.		
					8.50 p. m.		
					9.30 p. m.		
					10.05 p. m.		
					10.35 p. m.		
					11.00 p. m.		
					11.30 p. m.		
					12.05 a. m.		
					12.30 a. m.		
					1.02 a. m.		
					1.55 a. m.		
					2.20 a. m.		
					3.00 a. m.		
					3.20 a. m.		
					4.20 a. m.		
					4.40 a. m.		
					5.10 a. m.		
					5.45 a. m.		
					6.13 a. m.		
					6.45 a. m.		
					7.15 a. m.		
C20052	42 43 00	68 41 00	941	Mar. 2	6.15 p. m. to 9.30 p. m.	210	
C20053	42 45 00	67 28 00	941	Mar. 3	5.00 a. m. to 7.15 a. m.	235	

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Water. Depth.	Water. Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
2.22	0	3.33	0	32.47	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.					
	20	3.48	20	32.47						
	50	3.49	50	32.47						
	75	3.55	75	32.43	vert. net	170-0				
	100	3.54	100	32.49	botm. net		30			
	150	4.87	150	32.97	mtr. net		30			
					#10, #20	0	30			
2.78	0	3.33	0	32.52	El. sdr.; snap. ld.; GB bot.; NZ; R; Tycos.					
	20	2.79	20	32.51						
	50	2.79	50	32.52						
	100	3.04	100	32.54	vert. net	200-0				
	150	5.66	150	33.40	botm. net	200-0	30			Cable out (botm. net) 300 m.
	200	5.63	200	33.78						
					mtr. net	50-0	30			Cable out (mtr. net) 150 m.; net carried away.
					#10, #20	0	30			
6.7	0	2.50	0	32.35	GB bot.; NZ; Tycos.					
	20	1.95	20	32.34						
	40	1.89	40	32.36	vert. net	150-0	2			
	100	1.52	100	32.34	mtr. net	75-0	30			Cable out 150 meters, angle 60°-80°.
	150	1.68	150	32.39						
					#10, #20	0	30			
								Anchored. *Current.*		
					Ek. mtr					For this station the "direction" is magnetic and that from which current flows; "distance" is velocity of current in miles per hour.
						5	13.0	ENE	0.5	
						50	12.8	W	0.5	
						5	15.6	SW	0.97	
						50	13.06	SW	1.10	
						5	11.8	WNW	1.10	
						50	11.7	W by S	1.30	
						5	11.2	NW	0.70	
						50	11.3	NW	0.70	
						5	10.5	NW	1.20	
						50	11.4	NW	0.70	
						5	11.0	NW	0.50	
						50	11.3	NW	0.60	
						5	11.5	?	0.60	
						50	11.5	E	0.60	
						5	10.5	E	0.70	
						50	11.3	NE by E	0.60	
						5	11.0	ENE	0.50	
						5	11.5	NE	0.50	
						50	11.3	ESE	0.60	
						5	11.0	ENE	0.50	
						50	11.1	ESE	0.50	
						5	10.3	NE	0.60	
						50	10.6	SE	0.50	
-3.3	0	2.62	0	32.49	GB bot.; NZ; R.					
	20	2.24	20	32.52	vert. net	200-0	5			
	40	2.48	40	32.52	clsg. net	170	30			Cable out (clsg. net) 200 meters; successful haul.
	100	2.47	100	32.52						
	150	3.60	150	32.66						
	200	5.24	200	33.44	mtr. net					Mtr. net carried away; cable out 125 meters.
					#20, #10	0	30			
					#10	100-0				
0.0	0	2.78	0	32.54	GB bot.; NZ; Tycos.					
	20	2.20	20	32.59						
	40	2.34	40	32.57	vert. net	225-0				
	100	2.28	100	32.61	clsg. net	225	30			Cable out 250 meters.
	150	4.96	150	33.87						
	225	5.39	225	34.36	#20, #10	0	30			
					clsg. net	75	20			
					#10	0	15			

Dredging and Hydrographic Records Secured During Atlantic Cruises,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.	*Longitude W.*	*H. O.*	1920.		*Meters.*	
C20054	43 15 00	67 45 00	941	Mar. 3	11.10 a. m. to 2.10 p. m.	260	gy. M............
C20055	43 42 00	67 55 00	941	Mar. 3	5.54 p. m. to 7.30 p. m.	230	....
C20056	44 05 00	68 08 00	941	...do.....	10.45 p. m. to 12.00 m.	100	....
C20057	43 21 00	68 58 00	941	Mar. 4	7.15 a. m. to 8.30 a. m.	130	gy. M............
C20058	43 41 00	69 38 00	941	...do.....	1.10 p. m. to 2.18 p. m.	50	S., Sh............
C20059	43 25 00	70 12 00	941	...do.....	6.00 p. m. to 7.05 p. m.	95	gy. gn. M. and S..
C20060	43 02 00	70 27 00	941	...do.....	10.30 p. m. to 12.00 m.	98	gy. M..............
C20061	43 00 00	70 11 00	941	Mar. 5	1.30 a. m. to 3.00 a. m.	175	.....do............
C20062	42 26 00	70 42 30	941	...do.....	8.30 a. m. to 9.50 a. m.	50	bn. M., Sh........
....	42 20 00	70 40 00	....	Mar. 10	....	0	....
....	42 17 00	70 07 00	....	...do.....	....	0	....
....	42 12 00	69 06 00	....	...do.....	....	0	....
C20063	42 06 00	68 10 00	941	Mar. 11	1.30 a. m. to 3.40 a. m.	205	gy. M..............

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Water.		Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
	Depth.	Temp.								
°C.	M.	°C.	M.			M.	Min.		Mi.	
3.9	0	2.50	0	32.41	GB bot.; NZ; Tycos.	....	......	....	....	Clsg. net sent down, but failed to open. No sample at 250 m. Sample taken later at 225.
	20	1.84	20	32.39						
	40	1.84	40	32.39						
	100	1.77	100	32.41						
	175	5.40	175	33.75						
	250	5.48	225	34.00						
					vert. net	250–0	......	....	....	
					#20, #10	0	30	....	....	
					#10	100–0	25	....	....	Cable out 150 m.
3.9	0	2.50	0	32.38	GB bot.; NZ; Tycos.	....	......	....	....	
	20	1.85	20	32.39						
	40	1.82	40	32.41	vert. net	225–0	......	....	....	
	100	4.39	100	33.16	clsg. net	175	30	....	....	Cable out 210 meters.
	150	5.46	150	33.77						
	220	5.59	220	33.91	#20, #10	0	30	....	....	
3.3	0	1.15	0	32.21	GB bot.; NZ; Tycos.	....	......	....	....	
	20	.50	......	......						
	40	.49	......	......	vert. net	100–0	......	....	....	
	100	1.95	......	......	clsg. net, open	75–0	30	....	....	Open haul with clsg net.
					#20, #10	0	30	....	....	
4.4	0	2.22	0	32.39	GB bot.; NZ, Tycos.	....	......	....	....	
	20	1.91	20	32.40						
	40	1.91	40	32.41	vert. net	120–0	3	....	....	
	75	1.89	75	32.41	clsg. net, open	75–0	30	....	....	Do.
	125	2.00	125	32.43	#20, #10	0	30	....	....	
6.1	0	1.39	0	31.31	GB bot.; NZ; Tycos.	....	......	....	....	
	15	.68	15	32.00						
	45	1.43	45	32.34	vert. net	45–0	......	....	....	
					clsg. net, open	30–0	30	....	....	Open haul with clsg net. Cable out 45 meters.
					#20, #10	0	30	....	....	
5.6	0	1.11	0	32.09	GB bot.; NZ; Tycos.	....	......	....	....	
	20	.47	20	32.10						
	40	.61	......	......	vert. net	90–0	......	....	....	
	90	2.33	90	32.32	clsg. net, open	60–0	30	....	....	Open haul with clsg net.
					#20, #10	0	30	....	....	
5.6	0	1.39	0	32.28	GB bot.; NZ; Tycos.	....	......	....	....	
	20	1.25	20	32.27						
	40	1.28	40	32.30	vert. net	90–0	3	....	....	
	90	1.15	90	32.30	clsg. net, open	90–0	30	....	....	Do.
					#20, #10	0	30	....	....	
6.1	0	1.30	......	......	GB bot.; NZ; Tycos.	....	......	....	....	Deepest temp. repeated as check.
	20	.85	20	32.17						
	40	1.33	40	32.34	vert. net	175–0	......	....	....	
	100	1.96	100	32.41	clsg. net, open	100–0	30	....	....	
	165	4.29	......	......	#20, #10	0	35	....	....	
	175	4.26	175	32.91						
6.1	0	.78	0	32.14	GB bot.; NZ; Tycos.	....	......	....	....	
	20	.55	......	......						
	50	.33	50	32.16	vert. net	50–0	......	....	....	
					clsg. net, open	30–0	30	....	....	Open haul with clsg net. Cable out 40 meters.
					#20	0	15	....	....	
					#10	0	30	....	....	
......	0	1.1	0	32.00	....	....	......	....	....	
......	0	2.2	0	32.43	....	....	......	....	....	
......	0	2.2	0	32.65	....	....	......	....	....	
7.2	0	3.61	0	32.61	GB bot.; NZ; Tycos.	....	......	....	....	Alkalinity: Surf. and 190 meters, 7.9
	15	3.49	15	32.59						
	35	3.09	35	32.66						
	95	3.05	95	32.63	vert. net	190–0	......	....	....	
	140	4.30	140	33.16	clsg. net	190	25	....	....	Cable out (clsg. net) 200 meters, angle 20°, touched bottom.
	190	4.63	190	34.61						
	190	4.65	......	......						
					#20, #10	0	45	....	....	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*H. O.*	1920.		*Meters.*	
C20064	42 20 00	67 13 00	941	Mar. 11	10.00 a. m. to 12.40 p. m.	315	gn. M............
C20065	41 55 00	66 53 00	941	...do.....	5.15 p. m. to 6.25 p. m.	80	....
C20066	41 34 00	66 45 00	941	...do.....	9.00 p. m. to 12.00 m.	75	....
C20067	41 15 00	66 31 00	941	Mar. 12	2.55 a. m. to 4.15 a. m.	95	....
C20068	41 02.00	66 20 00	941	...do.....	7.45 a. m. to 9.00 a. m.	191	....
C20069	40 47 00	66 08 00	941	...do.....	11.30 a. m. to 2.05 p. m.	1,000	....
C20070	42 03 00	66 15 00	941	Mar. 13	2.00 a. m. to 3.09 a. m.	....	....
C20071	42 19 00	66 02 00	941	Mar. 13	5.00 a. m. to 6.30 a. m.	225	....
C20072	42 36 00	65 50 00	941	...do.....	8.20 a. m. to 9.30 a. m.	91	....
C20073	43 30 00	65 06 00	941	Mar. 17	12.57 p. m. to 2.20 p. m.	75	....

SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Temperature.			Salinity.		Apparatus	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	*M.*	*°C.*	*M.*			*M.*	*Min.*		*Mi.*	
8.9	0	3.50	0	32.84	GB bot.; NZ; Tycos.					Alkalinity: Surf., 7.9; 330 meters, 8.0.
	20	2.80	20	32.83						
	40	2.73	40	32.84						
	100	3.18	100	32.95	vert. net	340–0				
	150	4.26	150	33.66	clsg. net	165	30			
	200	4.32	200	34.69	#20, #10	0	30			
	265	4.24	265	34.76	clsg. net, open	125–0	20			Open haul with clsg. net.
	330	4.02	330	34.78						
8.3	0	3.61	0	32.63	GB bot.; NZ; Tycos.					Alkalinity: Surf. and 180 meters, 7.9.
	20	2.97	220	32.66						
	40	2.95	40	32.65						
	80	2.73	80	32.69	vert. net	80–0				
					mtr. net	40–0	30			Cable out (mtr. net) 75 meters, angle 40–45°.
					#20, #10	0	30			
8.3	0	3.33	0	32.57	GB bot.; NZ; Tycos.					Alkalinity: Surf. and 70 meters, 7.9.
	20	2.78	20	32.61						
	40	2.73	40	32.61						
	70	2.53	70	32.59	vert. net	70–0				
					mtr. net	60–0	30			Cable out (mtr. net) 70 meters.
					#20, #10	0	30			
					80′ cod	botm	60			Several ripe haddock taken.
8.3	0	3.05	0	32.68	GB bot.; NZ; Tycos.					Alkalinity: Surf. and 90 meters, 7.9.
	20	3.07	20	32.68						
	40	2.83	40	32.75						
	90	2.80	90	32.79	vert. net	90–0				
					mtr. net	50–0	35			Cable out 90 meters.
					#20, #10	0	40			
9.4	0	3.33	0	32.65	GB bot.; NZ; Tycos.					Alkalinity: Surf. 150, and 190 meters, 7.9.
	20	2.90	20	32.66						
	40	2.92	40	32.66						
	100	3.56	100	32.83	vert. net	150–0				
	150	4.40	150	33.86	mtr. net		30			Cable out 150 meters.
	190	4.92	190	34.23						
					#20, #10	0	30			
11.1	0	3.33	......	......	GB bot.; NZ; R; Tycos.					Alkalinity: Surf., and 1,000 meters, 7.9.
	50	3.11	50	32.79						
	100	7.09	100	33.86						
	150	7.01	150	34.63	clsg. net, open	1,000–0				Open haul with clsg. net.
	200	5.92	200	34.67						
	300	4.73	300	34.67	mtr. net	500–0	30			
	400	4.32	400	34.71	#20, #10	0	30			
	500	4.26	500	34.81						Between stations 20069 and 20070, Mar. 12, at 7.00–7.20 p. m., towed #10, ship slowed down.
	1,000	3.77	1,000	34.92						
9.4	0	3.05	0	32.66	GB bot.; NZ; Tycos.					Sea too rough to risk large nets.
	20	2.78	20	32.67						
	40	2.74	40	32.66	#20, #10	0	30			
	90	2.59	90	32.70						
10.0	0	3.33	0	32.81	GB bot.; NZ; R; Tycos.					
	20	2.90	20	32.83						
	40	3.15	40	32.86	vert. net	150–0				
	100	6.48	100	34.29	#20, #10	0	30			
	150	6.85	150	34.42						
	215	6.84	215	34.70						
9.4	0	1.95	0	32.32	GB bot.; NZ: R; Tycos.					Sea too rough to risk townets. Alkalinity: Surf., 7.95; 90 meters, 8.1.
	20	1.88	20	32.34						
	40	2.14	40	32.57						
	90	3.40	90	33.02						
					vert. net	75–0				
11.1	0	2.22	0	32.44	GB bot.; NZ: R; Tycos.					Alkalinity: Surf., 7.9.
	20	2.10	20	32.43						
	40	2.10	40	32.48	vert. net	70–0				
	70	2.52	70	32.71	#20, #10	0	30			
					#10	70–0	30			

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*H. O.*	1920.		*Meters.*	
C20074	43 18 00	64 58 00	941	Mar. 19	10.00 a. m. to 11.28 a. m.	160	....
C20075	42 55 00	64 36 00	941	...do.....	2.28 p. m. to 3.47 p. m.	95	....
C20076	42 33 00	64 30 00	941	...do.....	6.26 p. m. to 8.19 p. m.	250	....
C20077	42 24 00	64 19 00	941	Mar. 19–20.	9.50 p. m. to 12.30 a. m.	$\frac{0}{1000}$	....
C20078	42 58 00	65 48 00	941	Mar. 20	8.39 a. m. to 9.50 a. m.	170	....
C20079	44 21 00	66 37 00	941	Mar. 22	12.35 p. m. to 2.55 p. m.	210	rd. C..............
C20080	44 21 00	67 37 00	941	...do.....	8.15 p. m. to 9.14 p. m.	61	....
C20081	44 08 00	67 26 00	941	Mar. 22–23.	11.10 p. m. to 1.15 a. m.	206	....
C20082	43 54 00	66 53 00	941	Mar. 23	4.50 a. m. to 6.13 a. m.	125	....
C20083	43 41 00	66 21 00	941	...do.....	9.00 a. m. to 10.07 a. m.	68	....

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
3.9	0	1.39	0	32.09	GB bot.; NZ; R; Tycos.	......	......	......	......	Alkalinity: Surf. and 150 meters, 7.9.
	20	1.24	20	32.07						
	40	1.10	40	32.07						
	100	2.86	100	32.94	vert. net	150–0	......	......	......	
	150	4.68	150	33.69	mtr. net	125–0	30	......	......	Cable out 160 meters, angle 40°.
					#20, #10	0	30	......	......	
3.9	0	0.56	0	31.80	GB bot.; NZ; R; Tycos.	......	......	......	......	Alkalinity: Surf. and 90 meters, 8.0.
	20	0.27	20	31.83						
	40	0.45	40	31.82						
	90	3.76	90	33.21	vert. net	......	......	......	......	Angle 20°.
					mtr. net	90–0	......	......	......	Cable out 100 meters, angle 40°.
					#20, #10	80–0	30	......	......	
2.8	0	1.28	0	32.06	GB bot.; NZ; R. Tycos.	0	30	......	......	
	20	0.99	20	32.08						
	40	1.20	40	32.20	vert. net	250–0	......	......	......	
	100	7.39	......	......	clsg. net, open	120–0	30	......	......	Open haul; cable out 240 meters, angle 65°.
	150	8.61	150	34.34						
	200	8.92	200	34.70						
	250	6.20	250	34.65	mtr. net	70–0	30	......	......	Cable out 140 meters, angle 65°.
		5.28								
		5.53			#20	......	30	......	......	
5.0	0	1.67	0	32.16	GB bot.; NZ; R; Tycos.	......	......	......	......	
	40	1.29	40	32.19						
	100	5.82	100	33.78	clsg. net, open	800–0	30	......	......	Open haul with clsg. net, cable out 1,500 meters, angle 60°.
	150	6.05	150	34.88						
	200	7.89	200	34.85						
	300	6.32	300	34.85						
	500	4.23	500	34.83	mtr. net	500–0	30	......	......	Cable out 1,000 meters, angle 60°.
	1,000	3.90	1,000	34.88						
					#20, #10	0	30	......	......	
2.2	0	1.95	0	32.45	GB bot.; NZ; Tycos.	......	......	......	......	Alkalinity: Surf., 8.0.
	20	1.82	20	32.45						
	40	2.12	40	32.43	#10	110–0	30	......	......	
	100	2.67	100	32.72	#20, #10	0	30	......	......	
	165	4.59	165	33.58						
7.78	0	2.50	0	32.56	GB bot.; NZ; R; Tycos.	......	......	......	......	
	20	2.14	20	32.54						
	40	2.17	40	32.53	vert. net	210–0	......	......	......	
	100	2.55	100	32.70	clsg. net	170	25	......	......	Cable out 200 meters, angle 20°.
	150	3.32	150	33.01						
	200	4.29	200	33.31	#20, #10	0	45	......	......	
					clsg. net, open	180–0	30	......	......	Open haul; cable out 200 meters, angle 20–30°.
5.56	0	1.39	0	32.05	GB bot.; NZ; Tycos.	......	......	......	......	
	30	1.26	30	32.16						
	60	1.43	60	32.25	vert. net	60–0	......	......	......	
					mtr. net	30–0	30	......	......	Cable out 50 meters, angle 40°.
					#20, #10	0	30	......	......	
5.56	0	1.95	0	32.32	GB bot.; NZ; R; Tycos.	......	......	......	......	
	20	1.76	20	32.32						
	40	1.63	40	32.36	vert. net	200–0	......	......	......	
	100	2.26	100	32.59	clsg. net	170	30	......	......	Cable out 200 meters, angle 30–45°.
	150	5.07	150	33.67						
	200	5.39	200	33.84						
					#20, #10	0	35	......	......	
					mtr. net	160–0	30	......	......	Cable out 200 meters, angle 40°.
6.67	0	2.67	0	32.59	GB bot.; NZ; R; Tycos.	......	......	......	......	Alkalinity: Surf., 7.9.
	20	2.35	20	32.61						
	50	2.52	50	32.72	vert. net	120–0	......	......	......	
	120	3.35	120	33.15	mtr. net	70–0	30	......	......	Cable out 110 meters, angle 40°.
					#20, #10	0	30	......	......	
7.22	0	1.95	0	32.17	GB bot.; NZ; R; Tycos.	......	......	......	......	Alkalinity: Surf., 7.9.
	20	1.54	20	32.18						
	40	1.54	40	32.22	vert. net	65–0	......	......	......	
	65	2.04	65	32.54	mtr. net	30–0	25	......	......	Cable out 40 meters, angle 20–40°.
					#20, #10	0	35	......	......	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*C. S.*	1920.		*Meters.*	
C20084	43 18 00	66 09 00	1106	Mar. 23	2.00 p. m. to 3.00 p. m.	55	
C20085	43 17 00	66 33 00	1106	do	5.15 p. m. to 6.08 p. m.	70	
C20086	43 10 30	67 12 00	1106	do	9.30 p. m. to 11.20 p. m.	176	
C20087	42 37 00	69 27 00	1106	Mar. 24	3.50 p. m. to 5.30 p. m.	255	gy. M.
C20088	42 15 00	69 54 00	1106	Mar. 24	9.40 p. m. to 11.00 p. m.	180	
C20089	42 26 00	70 42 30	1106	Apr. 6	3.17 p. m. to 4.25 p. m.	60	
C20090	42 30 00	70 19 00	1106	Apr. 9	10.15 a. m. to 11.55 a. m.	134	
C20091	42 43 00	70 22 00	1106	do	1.50 p. m. to 2.55 p. m.	60	
C20092	42 49 00	70 37 00	1106	do	5.03 p. m. to 7.45 p. m.	85	
C20093	42 57 00	70 07 30	1106	do	10.30 p. m. to 11.50 p. m.	167	
C20094	43 08 00	69 39 30	1106	Apr. 10	3.00 a. m. to 4.15 a. m.	98	

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
8.33	0	2.11	0	32.16	GB bot.; NZ;					
	20	1.74	20	32.16	R; Tycos.					
	50	1.81	50	32.23	vert. net	50-0				
					mtr. net	40-0	30			Cable out 50 meters, angle 20-40°.
					#20, #10	0	30			
8.89	0	2.50			GB bot.; NZ;					Alkalinity: Surf., 7.9.
	30	2.40	30	32.63	R; Tycos.					
	70	2.43	70	32.63	mtr. net	60-0	30			Cable out 70 meters, angle 30°.
					#20, #10	0	30			
8.33	0	3.61			GB bot.; NZ;					
	20	3.40	20	33.10	R; Tycos.					
	40	3.39	40	33.10	vert. net	170-0				
	100	4.29	100	33.63	mtr. net	150-0	30			Cable out 170 meters, angle 30°.
	170	5.01	170	34.00						
					#20, #10	0	35			
11.67	0	3.05	0	32.49	GB bot.; NZ;					Alkalinity: Surf. and 250 meters, 7.9.
	20	2.74	20	32.56	R; Tycos.					
	40	2.74	40	32.54						
	100	2.80	100	32.63	vert. net	250-0				
	150	5.37	150	33.53	mtr. net	200-0	30			Cable out 250 meters, angle 35°.
	200	5.39	200	34.05						
	250	5.06	250	34.22	clsg. net	105	30			Cable out 125 meters, angle 35°.
					#20, #10	0	35			
8.33	0	2.50	0	32.36	GB bot.; NZ;					
	20	2.20	20	32.39	R; Tycos.					
	40	2.20	40	32.44	vert. net	160-0				Cable out 150 meters, angle 35°.
	100	3.61	100	32.92						
	180	4.97	180	33.58	mtr. net	125-0	30			
					#20, #10	0	30			
5.56	0	3.05	0	31.25	GB bot.; NZ;					Alkalinity: Surf., 7.95.
	10	2.39	10	31.26	Tycos.					
	25	2.31	25	31.30	vert. net	60-0				
	60	1.49	60	32.31	mtr. net	50-0	30			Cable out 60 meters, angle 30°.
					#20, #10	0	30			
4.4	0	3.33	0	32.36	GB bot.: NZ;					Alkalinity: Surf. and 120 meters, 7.9.
	10	2.50	10	32.34	R; Tycos.					
	30	2.42	30	32.34						
	90	2.34	90	32.47	vert. net	120-0				
	120	2.25	120	32.48	clsg. net	60	30			Cable out 75 meters, angle 35°.
					#20, mtr. net	0	30			
6.1	0	3.33	0	31.97	GB bot.; NZ;					Alkalinity: Surf., 8.0.
	20	2.48	20	32.08	R; Tycos.					
	60	2.50	60	32.45	mtr. net	30-0	30			Cable out 40 meters, angle 40°.
					#20, mtr. net	0	35			
5.6	0	3.05	0	31.01	GB bot.; NZ;					Alkalinity: Surf., 7.95.
	20	1.94			Tycos.					
	40	2.46			vert. net	80-0				
	80	2.35			75′ fldr	botm	90			Cable out 270 meters.
					#20, mtr. net	0	50			Mtr. net full of trash, was out over again.
3.9	0	3.05	0	31.92	GB bot.; NZ;					
	20	2.42	20	32.02	R.; Tycos.					
	40	2.26	40	32.35	vert. net	160-0				
	100	3.59	100	32.81	mtr. net	125-0	30			Cable out 150 meters, angle 30°.
	160	4.29	160	33.10						
					#20, mtr. net	0	35			
3.9	0	2.78	0	32.16	GB bot.; NZ;					
	20	2.34	20	32.17	Tycos.					
	40	2.46	40	32.41	vert. net	90-0				
	90	2.82	90	32.56	mtr. net	55-0	30			Cable out 70 meters, angle 35°.
					#20, #10	0	30			

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*C. S.*	1920.		*Meters.*	
C20095	43 25 00	70 12 00	1106	Apr. 10	7.45 a. m. to 8.55 a. m.	93	
C20096	43 40 00	69 37 00	1106	...do.....	12.20 p. m. to 1.35 p. m.	80	
C20097	43 19 00	68 54 30	1106	Apr. 10–11.	11.00 p. m. to 12.25 a. m.	130	
C20098	43 42 30	67 55 00	1106	Apr. 11	7.00 a. m. to 9.30 a. m.	216	
C20099	44 15 00	67 53 00	1106	Apr. 12	12.50 p. m. to 1.55 p. m.	73	
C20100	44 09 00	67 26 00	1106	...do.....	4.25 p. m. to 6.00 p. m.	230	
C20101	43 53 00	66 51 00	1106	...do.....	9.30 p. m. to 10.45 p. m.	150	
C20102	43 42 00	66 21 00	1106	Apr. 13	2.15 a. m. to 3.20 a. m.	66	
C20103	43 20 00	66 36 00	1106	Apr. 15	1.00 p. m. to 2.00 p. m.	92	
C20104	43 13 00	65 59 00	1106	...do.....	6.00 p. m. to 7.00 p. m.	46	
C20105	42 58 00	65 58 00	1106	...do.....	9.12 p. m. to 10.35 p. m.	134	

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
5.0	0	3.05	0	30.07	GB bot.; NZ; Tycos.	......	......	......	.....	Alkalinity: Surf., 8.0.
	20	2.71	......	......						
	40	2.25	40	32.50	vert. net	90-0	......	......	.....	
	90	2.22	......	......	mtr. net	55-0	30	......	.....	Cable out 70 meters, angle 40°.
					#20, #10	0	30	......	.....	
12.2	0	2.78	0	29.94	GB bot.; NZ; Tycos.	......	......	......	.....	Alkalinity: Surf., 8.0.
	20	2.02	20	31.60						
	60	2.39	60	32.41	vert. net	80-0	......	......	.....	
					mtr. net	35–0	30	......	.....	Cable out 45 meters, angle 30°.
					#20, mtr. net	0	30	......	.....	
4.4	0	3.33	0	32.43	GB bot.; NZ; R; Tycos.	......	......	......	.....	
	20	2.40	20	32.43						
	40	2.13	......	......	vert. net	130-0	......	......	.....	
	100	3.46	......	......	mtr. net	80–0	30	......	.....	Cable out 100 meters, angle 30°.
	125	4.51	125	33.26						
					#20, mtr. net	0	35	......	.....	
6.7	0	3.05	0	32.39	GB bot.; NZ; Tycos.	......	......	......	.....	Alkalinity: Surf., 7.95.
	20	2.33	20	32.44						
	40	2.53	......	......	clsg. net	125	30	......	.....	Operation of net prevented by seaweed.
	100	3.53	......	......						
	150	4.91	150	33.89						
	210	5.28	210	34.22	#20, mtr. net	0	35	......	.....	
					mtr. net	80–0	30	......	.....	Cable out 125 meters, angle 40–60°.
10.0	0	3.61	0	31.46	GB bot.; NZ; R; Tycos.	......	......	......	.....	Alkalinity: Surf., 7.9.
	20	2.23	20	31.90						
	40	2.34	40	32.38	vert. net	70–0	......	......	.....	
	70	2.60	70	32.56	mtr. net	40–0	30	......	.....	Cable out 50 meters, angle 30–40°.
					#20, mtr. net	0	30	......	.....	
7.8	0	3.89	0	32.49	GB bot.; NZ; R; Tycos.	......	......	......	.....	Alkalinity: Surf., 7.9.
	15	3.07	15	32.59						
	35	3.29	35	32.87	vert. net	225-0	......	......	.....	
	95	4.50	95	33.55	clsg. net, open	115–0	30	......	.....	Open haul, cable out 175 meters, angle 45°.
	145	5.06	145	33.98						
	195	5.12	195	34.06						
	225	5.14	225	34.09	mtr. net	50–0	30	......	.....	Cable out 75 meters, angle 45°.
					#20, mtr. net	0	30	......	.....	
7.8	0	4.28	0	32.89	GB bot.; NZ; R; Tycos.	......	......	......	.....	
	20	3.39	20	32.94						
	40	3.67	40	33.03	vert. net	150-0	......	......	.....	
	100	4.58	......	......	mtr. net	105–0	30	......	.....	Cable out 130 meters, angle 35°.
	140	4.71	140	33.78						
					#20, mtr. net	0	30	......	.....	
7.8	0	3.89	0	32.36	GB bot.; NZ; Tycos.	......	......	......	.....	
	20	3.26	......	......						
	40	3.00	40	32.56	vert. net	60-0	......	......	.....	
	60	2.83	60	32.56	mtr. net	35-0	30	......	.....	
					#20, mtr. net	0	30	......	.....	
10.6	0	3.89	0	32.74	GB bot.; NZ; R; Tycos.	......	......	......	.....	Alkalinity: Surf., 7.9.
	20	3.35	20	32.72						
	40	3.44	40	32.79	vert. net	90-0	......	......	.....	
	90	3.46	90	32.79	mtr. net	50-0	30	......	.....	Cable out 60 meters, angle 25°.
					#20	0	30	......	.....	Surf. mtr. net carried away.
7.8	0	3.05	0	32.32	GB bot.; NZ; R; Tycos.	......	......	......	.....	Alkalinity: Surf., 7.9.
	15	2.80	15	32.34						
	45	2.83	45	32.38	vert. net	45-0	......	......	.....	
					mtr. net	25–0	30	......	.....	Cable out 30 meters, angle 40°
					#20, Helgo. net	0	30	......	.....	
7.8	0	3.61	0	32.43	GB bot.; NZ; R; Tycos.	......	......	......	.....	
	20	3.61	20	32.42						
	35	3.11	35	32.77	vert. net	125-0	......	......	.....	
	95	3.16	95	32.83	mtr. net	50–0	30	......	.....	Cable out 75 meters, angle 40°.
	125	3.15	125	32.84						
					#20, Helgo. net	0	30	......	.....	

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES.

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*C. S.*	1920.		*Meters.*	
C20106	42 39 00	66 01 00	1106	Apr. 16	12.30 a. m. to 1.35 a. m.	83	....
C20107	42 19 00	66 02 00	1106	Apr. 16	4.36 a. m. to 5.55 a. m.	240	....
C20108	41 57 00	66 05 00	*H. O.* 941	...do.....	8.50 a. m. to 9.40 a. m.	130	....
C20109	41 17 00	66 09 00	941	...do.....	5.00 p. m. to 5.55 p.m.	150	....
C20110	41 38 00	66 26 00	941	...do.....	8.30 p. m. to 9.40 p. m.	80	....
C20111	41 58 30	66 43 00	941	Apr. 17	1.15 a. m. to 2.30 a. m.	70	....
C20112	42 22 00	67 02 00	*C. S.* 1106	...do.....	5.35 a. m. to 7.35 a. m.	290	....
C20113	42 53 00	67 37 00	1106	...do.....	1.00 p. m. to 2.30 p. m.	230	....
C20114	42 40 30	68 40 00	1106	...do.....	8.05 p. m. to 9.30 p. m.	180	....
....	42 28 00	69 17 00	1106	Apr. 18	1.00 a. m.	....	....
C20115	42 37 00	69 32 30	1106	Apr. 18	3.40 a. m. to 5.18 a. m.	290	....

SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Water.		Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
	Depth.	Temp.								
°*C.*	*M.*	°*C.*	*M.*			*M.*	*Min.*		*Mi.*	
7.2	0	3.61	0	32.72	GB bot.; NZ; R; Tycos.					
	20	3.40	20	32.74						
	40	3.35	40	32.73	vert. net	80-0				
	80	3.32	80	32.75	mtr. net	40-0	30			Cable out 50 meters, angle 35°.
					#20, Helgo. net	0	30			
8.9	0	3.33	0	32.34	GB bot.; NZ; R; Tycos.					Alkalinity: Surf., 7.9.
	20	3.10	20	32.34						
	40	3.21	40	32.56	vert. net:	240-0				
	100	5.86	100	33.86	mtr. net	135-0	30			Cable out 200 meters, angle 50°.
	170	7.45	170	34.59						
	240	6.07	240	34.69	#20, Helgo. net	0	30			
10.6	0	4.17	0	32.58	GB bot.; NZ; Tycos.					Alkalinity: Surf. and 130 meters, 7.9. Sea too rough for mtr. net.
	20	3.62	20	32.59						
	50	3.08	50	32.60						
	130	3.75	130	33.05						
					vert. net	135-0				
					#20, Helgo. net	0	30			
10.0	0	4.17	0	32.65	GB bot.; NZ; Tycos.					Alkalinity: Surf. and 150 meters, 7.9. Sea too rough for mtr. net.
	20	3.63	20	32.66						
	40	3.54	40	32.65						
	100	4.22	100	33.46						
	150	6.47	150	34.52						
					vert. net	155-0				
					#20; Helgo.net	0	20			
10.0	0	3.89	0	32.67	GB bot.; NZ; Tycos.					
	20	3.54	20	32.70						
	40	3.42	40	32.69	vert. net	80-0				
	80	3.59	80	32.70	mtr. net	55-0	30			Cable out 70 meters, angle 35°.
					#20; Helgo. net	0	30			
7.8	0	4.17	0	32.60	GB bot.; NZ; Tycos.					
	20	3.62	20	32.61						
	40	3.76	40	32.61	vert. net	65-0				
	70	3.75	70	32.64	mtr. net	40-0	30			Cable out 50 meters, angle 40°.
					#20; Helgo. net	0	30			
4.4	0	3.61	0	32.54	GB bot.;NZ; R; Tycos.					Alkalinity: Surf., 7.9.
	20	3.39	20	32.52						
	40	3.26	40	32.56	vert. net	290-0				
	100	3.15	100	32.86	mtr. net	200-0	30			Cable out 250 meters, angle 40°.
	175	5.28	175	34.56						
		5.17			clsg. net, open	105-0	30			Cable out 125 meters, angle 40°.
	225	4.72	225	34.70						
		4.60			#20; Helgo. net	0	30			
	290	4.70	290	34.70						
		4.73								
7.2	0	3.33	0	32.50	GB bot.;NZ; R; Tycos.					Alkalinity: Surf. 7.9.
	20	2.88	20	32.47						
	40	2.93	40	32.48	vert. net	230-0				
	100	4.32	100	33.51	mtr. net	130-0	30			Cable out 175 meters, angle 40°.
	165	5.16	165	34.23						
	230	5.16	230	34.43	clsg. net, open	60-0	30			Cable out 75 meters, angle 40°.
					#20; Helgo. net	0	25			
6.7	0	3.33	0	32.41	GB bot.; NZ; R; Tycos.					
	20	3.28	20	32.45						
	40	2.91	40	32.43	vert. net	175-0				
	100	4.12	100	33.19	mtr. net	125-0	25			Cable out 150 meters, angle 40°.
	175	4.96	175	34.18						
					#20; Helgo. net	0	25			
					Helgo. net	0	20			Across Fipennies ledge, ship slowed down, 20 min. toow.
5.6	0	3.61	0	32.45	GB bot.; NZ; R; Tycos.					
	20	3.33	20	32.48						
	40	3.20	40	32.47	vert. net	295-0				Angle 10°.
	100	3.02	100	32.80	mtr. net	200-0	30			Cable out 250 meters, angle 35°.
	150	5.38	150	33.69						
	200	6.36	200	33.93	#20 Helgo. net	0	30			
	290	4.92	290	34.34						

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*				*Meters.*	
C20116	42 03 00	69 38 00	*C. S.* 1106	1920. Apr. 18	9.55 a. m. to 11.10 a. m.	200	....
C20117	42 08 30	69 58 00	1106	...do.....	1.00 p. m. to 1.55 p. m.	89	....
C20118	41 51 00	70 18 00	1208	Apr. 20	10.50 a. m. to 12.00 m.	28	....
C20119	42 18 00	70 28 00	1106	...do.....	8.20 p. m. to 9.30 p. m.	90	....
C20120	42 27 00	70 25 00	*H. O.* 941	May 4	9.20 a. m. to 2.25 p. m.	70-50	....
C20121	42 27 00	70 25 00	941	...do.....	7.30 p. m. to 9.25 p. m.	60	....
C20122	42 49 00	70 37 00	941	May 7-8	9.50 p. m. to 2.10 a. m.	85	....
C20123	42 27 30	70 43 00	*C. S.* 1107	May 16	10.20 a. m. to 11.20 a. m.	55	....

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
Air.	Water.		Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
	Depth.	Temp.								
°C.	M.	°C.	M.			M.	Min.		Mi.	
6.7	0	3.61	0	32.14	GB bot.; NZ; R; Tycos.					Alkalinity: Surf., 8; 195 meters, 7.9.
	20	3.60	20	32.14						
	40	3.13	40	32.16	vert. net	200–0				
	100	3.42	100	32.79	mtr. net	125–0	25			Cable out 150 meters, angle 40°.
	195	4.25	195	33.91						
					#20, #6	0	20			
8.3	0	3.61	0	31.87	GB bot.; NZ; R; Tycos.					Alkalinity: Surf., 8.0.
	20	3.13	20	31.86						
	40	3.00	40	32.08	vert. net	85–0				
	85	3.24	85	32.78	mtr. net	40–0	25			Cable out 50 meters, angle 35°.
					#20, #6	0	25			
12.8	0	4.44	0	31.55	GB bot.; NZ; R; Tycos.					Alkalinity: Surf. 8.05.
	15	3.76	15	31.52						
	28	3.46	28	31.50	mtr. net	15–0	30			Cable out 20 meters, angle 35°.
					#20, #6	0	30			
10.6	0	3.61	0	31.43	GB bot.; NZ; R; Tycos.					
	20	2.87	20	31.56						
	40	1.58	40	32.03	vert. net	90–0				
	90	1.78	90	32.29	mtr. net	40–0	30			Cable out 50 meters, angle 40°.
					#20, #6	0	25			
7.8	0	6.39	0	29.16	GB bot.; NZ; R; Tycos.					Owing to wind and strong current ship drifted into shoal water several times.
	5	6.12	5	29.11						
	10	5.88	10	29.17						
	15	5.90	15	29.18						
	20	4.67	20	29.55						
	30	4.52	30	31.13						At this station experiments were made on flotation of haddock eggs.
	50	3.96	50	31.36						
	70	2.72	......	......						
					vert. net	48–0				
					mtr. net	40–0	30			Cable out 45 meters, angle 40°.
					clsg. net	25	30			Cable out 30 meters, angle 40°.
					clsg. net	15–10	30			Cable out 15 meters, angle 10°.
					#20, #6	0	35			
7.8	0	5.56	0	29.08	GB bot.; NZ; Tycos.					Alkalinity: Surf. and 60 meters, 8.15.
	30	3.92	30	30.99						
	60	2.39	60	32.24						
					vert. net	55–0				
					mtr. net	33–0	30			Cable out 40 meters, angle 35°.
					clsg. net	17	30			Cable out 20 meters, angle 35°.
					#20, #6	0	30			
					clsg. net	10–6	30			Cable out 15 meters.
12.8	0	7.22	0	28.26	GB bot.; NZ; R; Tycos.					Alkalinity: Surf., 8.15; 85 meters, 7.9.
	5	6.54	5	28.45						
	10	5.61	10	30.59						
	15	4.42	15	31.17	vert. net	95–0				
	20	4.18	20	31.24	mtr. net	65–0	30			Cable out 80 meters, angle 35–45°.
	35	3.10	......	......						
	50	3.13	50	32.17						
	65	2.43	65	32.25	clsg. net	33–26	30			Cable out 40 meters, angle 35–45°.
	85	2.30	85	32.38						
					#20, #6	0	30			
					clsg. net	20	30			Cable out 20 meters, angle 20°.
					80′ cod	botm.	60			Cable out 270 meters. Most of bag carried away.
20.0	0	8.89	0	29.94	GB bot.; NZ; Tycos.					Alkalinity: Surf., 8.0; 55 meters, 7.9.
	20	4.83	20	30.72						
	55	2.35	55	32.18						
					vert. net	55–0				
					#20	0	20			

DREDGING AND HYDROGRAPHIC RECORDS SECURED DURING ATLANTIC CRUISES,

Station number.	Bearings.		Chart.	Date.	Time of day.	Depth.	Character of bottom.
	Latitude N.,	*Longitude W.*	*C. S.*	1920.		*Meters.*	
C20124	42 28 00	70 18 00	1107	May 16	1.55 p. m. to 4.25 p. m.	100	....
C20125	42 00 00	69 41 00	1107	...do.....	9.50 p. m. to 11.00 p. m.	140	....
C20126	41 38 30	69 22 00	1107	May 17	2.20 a. m. to 3.40 a. m.	160	....
C20127	41 20 00	69 05 30	1107	...do.....	6.15 a. m. to 7.40 a. m.	145	....
C20128	40 34 00	68 52 30	1107	May 17	1.30 p. m. to 4.20 p. m.	70	....
C20129	40 05 00	69 03 30	1107	...do.....	7.30 p. m. to 9.00 p. m.	170	....
C20130	37 50 00	74 08 00	1109	May 19	6.50 a. m. to 7.40 a. m.	180	....

South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Temperature.			Salinity.		Apparatus.	Trial.		Drift.		Remarks.
	Water.									
Air.	Depth.	Temp.	Depth.	Salinity.		Depth.	Duration.	Direction.	Distance.	
°C.	M.	°C.	M.			M.	Min.		Mi.	
18.9	0	9.72	0	29.87	GB bot.; NZ; R; Tycos.	....	......	....	....	Alkalinity: Surf., 7.9; 100 meters, 7.9.
	20	5.12	20	30.77						
	40	2.89	40	32.07						
	100	2.65	100	32.45	75′ fldr. trl.	botm.	75	....	....	Cable out 270 meters, no catch.
					vert. net	100–0	......	....	....	
					mtr. net	72–0	20	....	....	Cable out 110 meters, angle 50°.
					clsg. net	40	20	....	....	Cable out 60 meters, angle 50°.
					#20; #6	0	20	....	....	Meter haul full of sand and gravel; not saved.
12.8	0	9.17	0	30.25	GB bot.; NZ; R; Tycos.	....	......	....	....	Alkalinity: Surf. and 140 meters, 7.9.
	20	5.73	20	32.07						
	40	3.78	40	32.34						
	100	3.58	100	32.92	vert. net	140–0	......	....	....	
	140	4.04	140	33.21	#6	100–0	20	....	....	Cable out 120 meters, angle 35°.
					clsg. net, open	50–0	20	....	....	Cable out 60 meters, angle 35°.
					#20; mtr. net	0	20	....	....	
12.8	0	8.33	0	31.53	GB bot.; NZ; R; Tycos.	....	......	....	....	Alkalinity: Surf. and 160 meters, 7.9.
	20	5.90	20	32.16						
	40	4.30	40	32.54						
	100	3.60	100	32.81	vert. net	155–0	......	....	....	
	160	4.10	160	33.49	#6	115–0	20	....	....	Cable out 140 meters, angle 35°.
					clsg. net, open	55–0	20	....	....	Cable out 70 meters, angle 35°.
					#20; mtr. net	0	15	....	....	
12.8	0	7.22	0	31.89	GB bot.; NZ; R; Tycos.	....	......	....	....	Alkalinity: Surf. and 145 meters, 7.9.
	20	5.75	20	32.24						
	40	4.10	......	......						
	100	3.80	100	32.88	vert. net	145–0	......	....	....	
	145	3.80	145	32.98	#6	105–0	15	....	....	Cable out 130 meters, angle 25°.
					clsg. net, open	54–0	15	....	....	Cable out 65 meters, angle 25°.
					#20; mtr. net	0	15	....	....	
14.4	0	7.78	0	32.48	GB bot.; NZ; R; Tycos.	....	......	....	....	Alkalinity: Surf. 7.9; 70 meters, 8.1.
	20	5.55	20	32.47						
	40	5.40	40	32.49						
	70	5.04	70	32.50	75′ fldr	botm.	90	....	....	Cable out 270 meters; no catch.
					vert. net	70–0	......	....	....	
					#6	40–0	15	....	....	Cable out 50 meters, angle 15°.
					clsg. net, open	20–0	15	....	....	Cable out 25 meters, angle 15°.
					#20; mtr. net	0	15	....	....	
12.2	0	7.78	0	32.61	GB bot.; NZ; Tycos.	....	......	....	....	Alkalinity: Surf. and 160 meters, 7.9.
	10	7.56	10	32.61						
	30	5.28	30	32.74						
		5.33			vert. net	160–0	......	....	....	Drifted into shoaler water before bottles were sent down.
	90	7.32	90	33.84						
	160	8.28	160	34.72						
					#6	100–0	15	....	....	Cable out 150 meters, angle 40°.
					clsg. net, open	50–0	15	....	....	Cable out 75 meters, angle 40°.
					#20; mtr. net	0	15	....	....	
15.6	0	12.22	0	33.17	GB bot.; NZ; Tycos.	....	......	....	....	Alkalinity: Surf. 8.0.
	20	9.75	20	33.55						
	40	9.82	40	34.04	vert. net	180–0	......	....	....	
	100	9.48	100	34.59						
	180	9.11	......	......						

Surface Temperatures Taken While Under Way During Atlantic Cruises, South from Norfolk, 1919, and North from Norfolk, 1920.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
		°	′	″	°	′	″			
1919.										
Oct. 30	....	....			....			....	....	C20001.
	5.30 p. m.	36	49	00	75	31	00	....	19.7	
	6.00 p. m.	36	48	00	75	25	30	20.0	21.1	
	6.30 p. m.	36	48	00	75	21	00	....	19.2	
	7.00 p. m.	36	48	00	75	16	00	19.4	17.8	
	7.30 p. m.	36	47	00	75	11	00	....	17.8	
	....	....			....			....	....	C20002.
	10.00 p. m.	36	46	00	75	01	05	19.4	17.2	
	10.30 p. m.	36	46	00	74	56	00	....	17.8	
	11.00 p. m.	36	45	00	74	51	00	18.9	17.2	
	11.30 p. m.	36	45	40	74	45	00	....	17.8	
Oct. 31	....	....			....			....	....	C20003.
	2.00 a. m.	36	43	00	74	38	00	19.4	17.8	
	....	....			....			....	....	C20004.
	6.30 a. m.	36	38	30	74	29	00	....	18.6	
	7.00 a. m.	36	37	00	74	26	00	20.0	18.6	
	7.30 a. m.	36	35	30	74	23	30	....	18.9	
	....	....			....			....	....	C20005.
	6.00 p. m.	36	35	00	74	25	00	21.7	19.4	
	6.30 p. m.	36	32	30	74	29	00	....	19.4	
	7.00 p. m.	36	30	00	74	37	00	21.1	18.9	
	7.30 p. m.	36	28	00	74	35	30	....	19.4	
	8.00 p. m.	36	25	30	74	39	00	21.1	18.9	
	8.30 p. m.	36	23	00	74	43	00	....	19.4	
	9.00 p. m.	36	20	30	74	46	30	21.1	18.0	
	9.30 p. m.	36	18	00	74	50	00	....	18.3	
	10.00 p. m.	36	16	00	74	53	00	21.1	18.9	
	10.30 p. m.	36	13	00	74	57	00	....	19.4	
	11.00 p. m.	36	11	00	75	01	00	21.1	19.4	
	11.30 p. m.	36	08	00	75	04	30	....	19.7	
	12.00 m.	36	06	00	75	08	00	20.6	20.6	
Nov. 1	12.30 a. m.	36	03	00	75	11	30	....	20.6	
	1.00 a. m.	36	01	00	75	15	00	15.6	20.6	
	1.30 a. m.	35	59	00	75	18	30	....	20.0	
	2.00 a. m.	35	56	30	75	22	00	18.3	20.3	
	2.30 a. m.	35	53	30	75	23	00	....	20.6	
	3.00 a. m.	35	49	00	75	21	00	21.1	21.1	
	3.30 a. m.	35	44	00	75	19	05	....	21.1	
	4.00 a. m.	45	40	00	75	11	00	21.1	21.1	
	4.30 a. m.	35	36	00	75	09	00	....	21.1	
	5.00 a. m.	35	32	00	75	08	30	22.2	21.1	
	5.30 a. m.	35	28	00	75	16	00	....	21.1	
	6.00 a. m.	35	25	00	75	15	00	22.2	21.1	
	6.30 a. m.	35	21	00	75	14	00	....	21.7	
	7.00 a. m.	35	17	00	75	12	00	22.8	22.2	
	7.30 a. m.	35	14	00	75	12	30	....	27.8	
	8.00 a. m.	35	12	00	75	13	30	23.3	25.0	
	8.30 a. m.	35	09	00	75	14	30	....	23.3	
	9.00 a. m.	35	07	00	75	15	00	26.7	23.0	
	9.30 a. m.	35	04	30	75	16	30	....	23.3	
	....	....			....			....	....	C20006.
	11.30 a. m.	35	03	00	75	16	30	....	24.2	
	12.00 m.	35	02	00	75	15	00	26.1	23.9	
	....	....			....			....	....	C20007.
	3.30 p. m.	35	00	00	75	13	30	....	27.0	
	4.00 p. m.	34	59	30	75	12	20	26.7	25.3	
	4.30 p. m.	34	59	00	75	11	30	....	25.0	
	5.00 p. m.	34	58	00	75	10	30	26.1	27.0	
	5.30 p. m.	34	57	00	75	10	00	....	26.7	
	6.00 p. m.	34	56	00	75	09	00	27.8	27.0	
	6.30 p. m.	34	56	00	75	08	00	....	27.5	
	7.00 p. m.	34	55	00	75	07	00	26.7	26.7	
	....	....			....			....	....	20008.
	11.30 p. m.	34	59	00	75	03	00	....	28.6	
	12.00 m.	35	00	00	75	04	00	26.1	28.3	
Nov. 2	12.30 a. m.	35	00	00	75	05	20	....	27.5	
	1.00 a. m.	35	00	30	75	07	00	26.7	26.1	
	1.30 a. m.	35	01	00	75	08	00	....	26.7	
	2.00 a. m.	35	01	00	75	09	00	27.0	25.6	
	2.30 a. m.	35	02	00	75	10	00	....	25.0	
	3.00 a. m.	35	02	00	75	11	30	27.0	25.3	
	3.30 a. m.	35	03	00	75	13	00	....	25.0	
	4.00 a. m.	35	03	00	75	14	00	27.0	25.6	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1919.		°	′	″	°	′	″			
Nov. 2	4.30 a. m.		(a)			(a)		....	25.3	
	5.00 a. m.		(a)			(a)		27.0	25.6	
	5.30 a. m.		(a)			(a)		....	25.6	
	6.00 a. m.		(a)			(a)		27.0	25.3	
	6.30 a. m.		(a)			(a)		....	25.6	
	7.00 a. m.		(a)			(a)		27.0	25.3	
	7.30 a. m.		(a)			(a)		....	25.0	
	8.00 a. m.	35	02	00	75	25	00	23.9	25.0	
	8.30 a. m.	34	58	00	75	26	00	....	24.7	
	9.00 a. m.	34	57	00	75	29	00	24.4	25.0	
	9.30 a. m.	34	55	00	75	32	00	....	26.7	
	10.00 a. m.	34	53	00	75	35	00	23.9	26.7	
	10.30 a. m.	34	50	00	75	38	00	....	26.7	
	11.00 a. m.	34	48	00	75	41	00	23.9	26.7	
	11.30 a. m.	34	45	00	75	44	00	....	26.7	
	12.00 m.	34	43	00	75	47	00	23.9	26.7	
	12.30 p. m.	34	41	00	75	49	30	....	26.9	
	1.00 p. m.	34	38	00	75	52	30	22.2	26.7	
	1.30 p. m.	34	35	00	75	56	00	....	26.7	
	2.00 p. m.	34	34	30	75	58	00	21.1	26.7	
	2.30 p. m.	34	31	00	76	01	00	....	26.7	
	3.00 p. m.	34	29	00	75	04	00	21.1	25.8	
	3.30 p. m.	34	27	00	76	06	00	....	26.1	
	4.00 p. m.	34	25	00	76	10	30	20.6	26.1	
	4.30 p. m.	34	23	00	76	13	00	....	25.8	
	5.00 p. m.	34	21	00	76	16	00	20.0	25.3	
	5.30 p. m.	34	20	00	76	19	30	....	25.6	
	6.00 p. m.	34	17	00	76	22	00	20.0	24.4	
	6.30 p. m.	34	15	00	76	25	00	....	25.0	
	7.00 p. m.	34	13	30	76	28	30	20.0	25.3	
	7.30 p. m.	34	11	00	76	31	30	....	25.6	
	8.00 p. m.	34	09	00	76	34	40	20.0	23.3	
	8.30 p. m.	34	07	00	76	38	00	....	24.4	
	9.00 p. m.	34	04	00	76	42	00	20.6	25.3	
	9.30 p. m.	34	02	00	76	45	00	....	24.7	
	10.00 p. m.	33	59	00	76	48	30	20.6	24.4	
	10.30 p. m.	33	53	00	76	52	00	....	23.9	
	11.00 p. m.	33	54	00	76	56	00	20.0	23.6	
	11.30 p. m.	33	52	00	76	59	00	....	23.3	
	12.00 m.	33	49	00	77	03	00	20.0	22.2	
Nov. 3	12.30 a. m.	33	47	00	77	06	00	....	22.8	
	1.00 a. m.	33	44	30	77	10	00	19.4	22.5	
	1.30 a. m.	33	42	00	77	13	30	....	25.6	
	2.00 a. m.	33	39	30	77	17	00	19.4	23.0	
	2.30 a. m.	33	37	00	77	20	30	....	23.3	
	3.00 a. m.	33	34	30	77	24	00	20.0	22.8	
	3.30 a. m.	33	32	00	77	27	00	....	23.0	
	4.00 a. m.	33	29	00	77	32	00	20.6	22.8	
	4.30 a. m.	33	26	00	77	37	30	....	24.4	
	5.00 a. m.	33	24	30	77	43	00	20.6	23.3	
	5.30 a. m.	33	22	00	77	48	00	....	24.4	
	6.00 a. m.	33	20	00	77	53	00	20.0	24.7	
	6.30 a. m.	33	18	00	77	57	30	....	24.7	
	7.00 a. m.	33	16	00	78	03	00	20.6	24.4	
	7.30 a. m.	33	14	00	78	08	00	....	24.7	
	8.00 a. m.	33	11	30	78	13	00	21.1	25.0	
	8.30 a. m.	33	09	00	78	18	00	....	24.7	
	9.00 a. m.	33	07	00	78	23	00	21.1	25.3	
	9.30 a. m.	33	05	00	78	28	00	....	25.0	
	10.00 a. m.	33	02	30	78	33	00	21.1	24.4	
	10.30 a. m.	33	00	00	78	37	00	....	25.7	
	11.00 a. m.	32	58	00	78	43	00	21.1	25.3	
	11.30 a. m.	32	56	00	78	47	30	....	25.0	
	12.00 m.	32	54	00	78	52	00	21.1	25.0	
	12.30 p. m.	32	51	30	78	57	30	....	25.3	
	1.00 p. m.	32	50	00	79	03	30	22.2	24.4	
	1.30 p. m.	32	48	00	79	08	00	....	24.4	
	2.00 p. m.	32	46	30	79	13	00	22.2	24.7	
	2.30 p. m.	32	45	00	79	17	30	....	24.7	
	3.00 p. m.	32	43	00	79	23	00	22.8	25.0	
	3.30 p. m.	32	41	30	79	28	00	....	24.7	
	4.00 p. m.	32	40	00	79	33	00	22.8	24.7	
	4.30 p. m.	32	38	00	79	39	00	....	24.7	

(a) Standing on and off Diamond Shoal (Cape Hatteras).

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1919.		°	′	″	°	′	″			
Nov. 3	5.00 p. m.	32	35	30	79	44	00	22.2	25.0	
	5.30 p. m.	32	33	30	79	48	00	....	24.4	
	6.00 p. m.	32	30	00	79	51	30	22.2	24.4	
	6.30 p. m.	32	27	30	79	55	00	....	24.4	
	7.00 p. m.	32	23	00	79	59	30	22.2	23.9	
	7.30 p. m.	32	20	00	80	03	00	....	24.2	
	8.00 p. m.	32	17	00	80	07	00	25.6	24.4	
	8.30 p. m.	32	14	00	80	11	00	....	23.9	
	9.00 p. m.	32	10	30	80	15	00	25.6	24.4	
	9.30 p. m.	32	07	30	80	19	00	....	24.4	
	10.00 p. m.	32	04	30	80	23	00	25.6	24.7	
	10.30 p. m.	32	01	00	80	25	00	....	24.7	
	11.00 p. m.	31	57	00	80	29	00	25.6	25.0	
	11.30 p. m.	31	53	00	80	30	00	....	24.7	
	12.00 m.	31	50	00	80	32	00	25.6	24.4	
Nov. 4	12.30 a. m.	31	46	30	80	34	30	....	25.0	
	1.00 a. m.	31	43	00	80	37	00	23.3	25.0	
	1.30 a. m.	31	40	00	80	39	00	....	25.0	
	2.00 a. m.	31	36	00	80	42	00	22.8	25.6	
	2.30 a. m.	31	32	30	80	44	00	....	25.6	
	3.00 a. m.	31	28	30	80	47	00	22.2	25.3	
	3.30 a. m.	31	25	00	80	49	30	....	25.6	
	4.00 a. m.	31	21	30	80	51	30	22.2	25.3	
	4.30 a. m.	31	18	00	80	54	00	....	25.8	
	5.00 a. m.	31	14	00	80	56	30	21.7	25.8	
	5.30 a. m.	31	09	30	80	59	00	....	25.8	
	6.00 a. m.	31	07	00	81	02	00	20.6	26.1	
	6.30 a. m.	31	03	00	81	04	00	....	26.1	
	7.00 a. m.	31	00	00	81	07	00	20.6	26.1	
	7.30 a. m.	30	56	00	81	08	00	....	26.4	
	8.00 a. m.	30	52	00	81	09	00	20.6	26.1	
	8.30 a. m.	30	47	00	81	11	00	....	26.1	
	9.00 a. m.	30	44	30	81	12	00	21.7	25.8	
	9.30 a. m.	30	40	30	81	13	30	....	26.1	
	10.00 a. m.	30	36	00	81	15	00	22.2	25.6	
	10.30 a. m.	30	32	30	81	17	00	....	26.1	
	11.00 a. m.	30	29	00	81	18	00	22.8	25.8	
	11.30 a. m.	30	25	00	81	21	00	....	26.7	
Nov. 9	2.00 p. m.	30	22	30	81	21	30	23.3	24.4	
	2.30 p. m.	30	18	30	81	20	00	....	24.4	
	3.00 p. m.	30	14	30	81	18	00	23.9	24.4	
	3.30 p. m.	30	11	00	81	17	00	....	25.0	
	4.00 p. m.	30	07	30	81	15	30	23.3	25.3	
	4.30 p. m.	30	04	00	81	13	30	....	24.2	
	5.00 p. m.	30	00	00	81	12	00	22.8	24.7	
	....	......	......	......	......	......	......	....	....	20009.
	6.30 p. m.	29	49	00	81	06	00	....	25.8	
	7.00 p. m.	29	45	30	81	04	00	22.8	25.3	
	7.30 p. m.	29	42	00	81	01	30	....	25.0	
	8.00 p. m.	29	38	30	80	59	30	23.3	25.0	
	8.30 p. m.	29	34	30	80	57	30	....	24.7	
	9.00 p. m.	29	31	30	80	55	00	23.9	25.6	
	9.30 p. m.	29	28	30	80	53	00	....	24.4	
	10.00 p. m.	29	25	30	80	51	30	23.3	25.0	
	10.30 p. m.	29	22	30	80	49	30	....	25.0	
	11.00 p. m.	29	19	30	80	47	30	23.9	25.0	
	11.30 p. m.	29	16	00	80	45	30	....	25.3	
	12.00 m.	29	12	30	80	43	00	23.9	25.0	
Nov. 10	12.30 a. m.	29	09	00	80	41	30	....	25.0	
	1.00 a. m.	29	05	00	80	39	00	26.7	25.0	
	1.30 a. m.	29	01	00	80	36	30	....	25.0	
	2.00 a. m.	28	58	00	80	34	30	25.0	25.0	
	2.30 a. m.	28	54	00	80	32	00	....	25.0	
	3.00 a. m.	28	50	30	80	30	00	25.0	25.3	
	3.30 a. m.	28	47	30	80	27	30	....	24.4	
	4.00 a. m.	28	44	00	80	25	00	23.9	25.0	
	4.30 a. m.	28	40	30	80	23	00	....	24.4	
	5.00 a. m.	28	36	30	80	21	00	22.2	24.7	
	5.30 a. m.	28	33	00	80	19	00	....	24.7	
	6.00 a. m.	28	30	00	80	18	30	22.8	25.3	
	6.30 a. m.	28	26	00	80	18	00	....	25.0	
	7.00 a. m.	28	23	00	80	17	30	22.2	25.0	
	7.30 a. m.	28	19	00	80	17	00	....	25.3	
	8.00 a. m.	28	15	00	80	16	00	22.2	25.0	
	8.30 a. m.	28	11	00	80	15	30	....	25.3	
	9.00 a. m.	28	07	00	80	15	00	25.6	25.3	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1919.		°	′	″	°	′	″			
Nov. 10	9.30 a. m.	28	03	30	80	14	30	....	25.3	
	10.00 a. m.	27	59	00	80	14	00	26.1	25.0	
	10.30 a. m.	27	55	30	80	13	30	....	25.3	
	11.00 a. m.	27	51	30	80	13	00	26.7	25.3	
	11.30 a. m.	27	47	30	80	12	30	....	25.3	
	12.00 m.	27	44	00	80	12	00	26.7	25.3	
	12.30 p. m.	27	40	30	80	11	30	....	25.0	
	1.00 p. m.	27	37	30	80	11	00	26.1	25.0	
	1.30 p. m.	27	34	00	80	10	00	....	25.0	
	....	......	......	......	......	......	......	....	....	20010.
	2.30 p. m.	27	34	30	80	05	00	....	25.0	
	3.00 p. m.	27	34	00	80	00	30	27.0	26.7	
	3.30 p. m.	27	34	00	79	56	00	....	27.8	
	....	......	......	......	......	......	......	....	....	C20011.
	5.00 p. m.	27	36	30	79	52	30	27.0	26.7	
	5.30 p. m.	27	36	00	79	48	00	....	26.9	
	6.00 p. m.	27	35	30	79	43	30	26.7	26.7	
	6.30 p. m.	27	35	00	79	38	30	....	26.7	
	....	......	......	......	......	......	......	....	....	C20012.
	9.30 p. m.	27	40	30	79	32	00	25.6	27.5	
	10.00 p. m.	27	39	00	79	28	00	25.0	27.0	
	10.30 p. m.	27	38	00	79	24	30	....	27.0	
	11.00 p. m.	27	37	00	79	20	00	25.0	26.7	
	11.30 p. m.	27	35	30	79	16	00	....	26.9	
	12.00 m.	27	34	30	79	12	00	25.0	26.7	
Nov. 11	....	......	......	......	......	......	......	....	....	20013.
	2.30 a. m.	27	34	00	79	15	30	....	27.0	
	3.00 a. m.	27	32	00	79	19	00	24.4	27.0	
	3.30 a. m.	27	29	00	79	22	30	....	27.0	
	4.00 a. m.	27	27	00	79	26	00	24.4	27.0	
	4.30 a. m.	27	24	00	79	29	30	....	25.6	
	5.00 a. m.	27	21	30	79	33	00	25.0	26.7	
	5.30 a. m.	27	19	00	79	36	00	....	26.7	
	6.00 a. m.	27	16	30	79	39	30	25.6	26.7	
	6.30 a. m.	27	13	30	79	43	00	....	26.1	
	7.00 a. m.	27	12	00	79	46	00	26.1	26.7	
	7.30 a. m.	27	09	00	79	50	00	....	26.7	
	8.00 a. m.	27	06	00	79	53	30	26.1	26.1	
	8.30 a. m.	27	03	30	79	57	00	....	26.1	
	9.00 a. m.	27	00	00	80	00	00	26.1	25.6	
	9.30 a. m.	26	56	30	80	01	00	....	26.1	
	10.00 a. m.	26	52	00	80	01	30	25.6	26.7	
	10.30 a. m.	26	47	30	80	01	30	....	26.1	
	11.00 a. m.	26	43	00	80	01	30	25.6	26.4	
	11.30 a. m.	26	39	30	80	01	30	....	26.1	
	12.00 m.	26	35	00	80	01	30	25.6	26.1	
	12.30 p. m.	26	31	00	80	02	00	....	26.7	
	1.00 p. m.	26	26	30	80	02	00	26.1	26.7	
	1.30 p. m.	26	22	30	80	02	00	....	26.7	
	2.00 p. m.	26	18	30	80	02	30	26.1	26.7	
	2.30 p. m.	26	15	00	80	02	30	....	26.4	
	3.00 p. m.	26	11	00	80	02	30	26.1	26.1	
	3.30 p. m.	26	07	00	80	03	00	....	26.7	
	4.00 p. m.	26	02	00	80	03	00	26.7	26.4	
	4.30 p. m.	25	57	30	80	03	00	....	26.7	
	5.00 p. m.	25	53	00	80	03	00	26.1	26.7	
	5.30 p. m.	25	49	00	80	03	00	....	26.1	
	6.00 p. m.	25	44	30	80	03	30	24.4	26.1	
	....	......	......	......	......	......	......	....	....	20014.
	....	......	......	......	......	......	......	....	....	C20015.
	10.30 p. m.	25	36	00	79	55	00	....	26.7	
	11.00 p. m.	25	35	00	79	51	30	23.3	26.9	
	11.30 p. m.	25	34	30	79	48	00	....	26.7	
	12.00 m.	25	34	00	79	45	00	23.3	27.0	
Nov. 12	....	......	......	......	......	......	......	....	....	C20016.
	3.30 a. m.	25	39	30	79	42	00	....	26.7	
	4.00 a. m.	25	38	00	79	38	00	25.6	26.7	
	4.30 a. m.	25	36	00	79	34	00	....	26.9	
	5.00 a. m.	25	35	00	79	30	00	25.0	26.7	
	....	......	......	......	......	......	......	....	....	C20017.
	8.30 a. m.	25	32	30	79	34	00	....	27.8	
	9.00 a. m.	25	30	30	79	38	00	27.8	27.8	
	9.30 a. m.	25	29	00	79	40	30	....	27.8	
	10.00 a. m.	25	27	30	79	43	30	28.3	28.0	
	10.30 a. m.	25	25	00	79	46	30	....	27.8	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken
								Air.	Surface.	
1919.		°		″	°	′	″			
Nov. 12	11.00 a. m.	25	23	30	79	50	00	29.4	27.8	
	11.30 a. m.	25	22	00	79	52	30		27.8	
	12.00 m.	25	20	00	79	56	00	30.0	27.5	
	12.30 p. m.	25	18	00	79	59	00		27.8	
	1.00 p. m.	25	16	00	80	02	00	30.0	27.5	
	1.30 p. m.	25	14	00	80	05	00		27.0	
	2.00 p. m.	25	12	00	80	09	00	30.0	26.7	
	2.30 p. m.	25	09	30	80	11	30		26.1	
	3.00 p. m.	25	06	30	80	14	00	28.8	26.1	
	3.30 p. m.	25	04	00	80	16	00		26.7	
	4.00 p. m.	25	01	00	80	18	30	27.0	26.4	
	4.30 p. m.	24	58	00	80	22	00		26.4	
	5.00 p. m.	24	55	30	80	25	30	25.6	26.1	
	5.30 p. m.	24	53	00	80	29	00		26.1	
	6.00 p. m.	24	50	00	80	34	00	25.6	26.7	
	6.30 p. m.	24	47	30	80	38	00		26.7	
	7.00 p. m.	24	45	00	80	42	00	25.6	26.7	
	7.30 p. m.	24	42	30	80	46	30		26.7	
	8.00 p. m.	24	40	00	80	50	30	25.6	26.4	
	8.30 p. m.	24	39	00	80	54	00		26.4	
	9.00 p. m.	24	38	30	80	57	30	25.6	26.4	
	9.30 p. m.	24	37	00	81	01	00		26.7	
	10.00 p. m.	24	36	30	81	03	00	25.6	26.7	
	10.30 p. m.	24	35	00	81	06	00		26.7	
	11.00 p. m.	24	34	30	81	09	00	25.6	26.7	
	11.30 p. m.	24	34	00	81	12	00		26.7	
	12.00 m.	24	33	00	81	15	00	25.6	26.9	
Nov. 13	12.30 a. m.	24	32	00	81	18	00		26.7	
	1.00 a. m.	24	31	30	81	21	00	25.6	26.4	
	1.30 a. m.	24	30	00	81	24	30		26.7	
	2.00 a. m.	24	29	00	81	28	00	25.6	26.7	
	2.30 a. m.	24	28	00	81	31	00		26.7	
	3.00 a. m.	24	29	00	81	34	30	24.4	26.7	
	3.30 a. m.	24	27	30	81	37	00		26.7	
	4.00 a. m.	24	26	30	81	40	00	23.3	26.7	
	4.30 a. m.	24	26	30	81	44	00		26.7	
	5.00 a. m.	24	25	00	81	47	30	24.4	26.7	
	5.30 a. m.	24	24	30	81	51	30		26.7	
Nov. 15										C20018.
	8.30 p. m.	24	19	00	81	57	00	25.0	26.1	
	9.00 p. m.	24	17	30	81	58	00	24.4	25.8	
	9.30 p. m.	24	12	00	82	00	00	23.9	25.8	
Nov. 15 to 16										C20019.
Nov. 16	1.30 a. m.	24	02	30	81	59	00	25.0	26.7	
										C20020.
	6.00 a. m.	23	50	00	82	03	30	25.0	27.5	
	6.30 a. m.	23	47	00	82	06	00		27.8	
										C20021.
	11.00 a. m.	23	34	30	82	10	00	27.0	28.3	
	11.30 p. m.	23	31	00	82	12	30		28.3	
										20022.
	2.30 p. m.	23	24	00	82	15	00		28.0	
	3.00 p. m.	23	21	00	82	16	00	27.0	28.0	
	3.30 p. m.	23	18	00	82	17	00		28.0	
	4.00 p. m.	23	15	30	82	18	30	27.8	28.0	
	4.30 p. m.	23	12	30	82	20	00		28.0	
Nov. 21	9.00 a. m.	23	12	30	82	17	00		27.0	
										C20023.
	2.30 p. m.	23	13	00	82	32	00	26.7	27.8	
	3.00 p. m.	23	12	00	82	36	00	27.8	27.0	
	3.30 p. m.	23	11	00	82	41	00	27.8	27.0	
	4.00 p. m.	23	10	00	82	45	30	27.8	27.0	
	4.30 p. m.	23	09	00	82	50	00		27.5	
	5.00 p. m.	23	08	00	82	54	00	27.8	27.5	
	5.30 p. m.	23	08	00	82	58	00		27.5	
	6.00 p. m.	23	07	00	83	03	00	27.8	27.5	
	6.30 p. m.	23	06	00	83	07	00		27.5	
	7.00 p. m.	23	05	00	83	11	30	26.1	26.9	
	7.30 p. m.	23	04	00	83	15	00		27.5	
	8.00 p. m.	23	03	00	83	19	00	25.6	27.5	
	8.30 p. m.	23	02	00	83	22	00		27.5	
	9.00 p. m.	23	01	00	83	25	00	26.1	27.5	
	9.30 p. m.	23	00	00	83	29	00		27.0	
	10.00 p. m.	22	59	00	83	32	30	25.6	27.0	
	10.30 p. m.	22	58	00	83	36	00		27.5	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken
								Air.	Surface.	
1919.		°	′	″	°	′	″			
Nov. 21	11.00 p. m.	22	57	00	83	39	00	25.0	27.0	
	11.30 p. m.	22	56	00	83	43	00		27.0	
	12.00 m.	22	54	30	83	46	30	25.0	27.0	
Nov. 22	12.30 a. m.	22	53	00	83	50	00		27.0	
	1.00 a. m.	22	52	00	83	53	00	26.7	27.0	
	1.30 a. m.	22	51	30	83	57	00		27.0	
	2.00 a. m.	22	50	00	84	00	00	25.7	27.5	
	2.30 a. m.	22	49	00	84	04	00		27.5	
	3.00 a. m.	22	48	00	84	08	30	25.6	27.0	
	3.30 a. m.	22	46	00	84	13	30		27.0	
	4.00 a. m.	22	45	00	84	17	30	26.1	26.9	
	4.30 a. m.	22	43	30	84	22	00		27.0	
	5.00 a. m.	22	40	00	84	24	00	26.1	27.0	
	5.30 a. m.	22	37	30	84	27	00		27.0	
	6.00 a. m.	22	34	00	84	30	00	25.6	27.0	
	6.30 a. m.	22	31	30	84	32	00		27.5	
	7.00 a. m.	22	28	00	84	35	00	25.6	26.9	
	7.30 a. m.	22	25	00	84	37	30		26.9	
	8.00 a. m.	22	22	00	84	40	30	25.6	27.0	
	8.30 a. m.	22	19	00	84	43	00		27.0	
	9.00 a. m.	22	15	30	84	46	00	25.6	27.0	
	9.30 a. m.	22	13	00	84	48	00		27.5	
	10.00 a. m.	22	09	00	84	51	00	25.6	26.9	
	10.30 a. m.	22	06	00	84	54	00		26.9	
	11.00 a. m.	22	03	00	84	57	00	25.6	27.0	
	11.30 a. m.	22	00	00	84	59	00		26.7	
	12.00 m.	21	56	30	85	02	30	25.6	26.7	
	12.30 p. m.	21	53	30	85	05	00		26.4	
										C20024.
	7.00 p. m.	21	49	30	85	17	00	26.7	26.7	
	7.30 p. m.	21	48	30	85	21	00		27.8	
	8.30 p. m.	21	47	00	85	28	30	26.4	27.8	
	9.00 p. m.	21	46	00	85	32	30	26.1	27.8	
	9.30 p. m.	21	45	00	85	36	30		27.8	
Nov. 22 to 23										C20025.
Nov. 23	2.30 a. m.	21	46	00	85	46	30		27.5	
	3.00 a. m.	21	43	00	85	50	00	25.5	27.5	
	3.30 a. m.	21	40	30	85	54	00		27.5	
	4.00 a. m.	21	38	00	85	57	30	25.0	27.8	
	4.30 a. m.	21	36	00	86	01	00		27.8	
	5.00 a. m.	21	33	00	86	05	00	24.4	27.8	
										C20026.
	11.00 a. m.	21	40	00	86	13	30	25.0	26.9	
	11.30 a. m.	21	39	30	86	17	30		26.9	
	12.00 m.	21	39	00	86	21	00	24.4	27.0	
	12.30 p. m.	21	38	00	86	24	00		27.0	
	1.00 p. m.	21	37	00	86	28	00	27.8	27.0	
	1.30 p. m.	21	36	00	86	32	00		27.5	
										C20027.
	5.30 p. m.	23	46	00	86	32	00		27.0	
	6.00 p. m.	23	51	00	86	27	00	26.1	27.5	
	6.30 p. m.	23	53	30	86	24	30		27.0	
	7.00 p. m.	23	56	00	86	22	00	25.6	27.0	
	7.30 p. m.	23	58	00	86	19	30		27.5	
	8.00 p. m.	22	01	30	86	16	30	25.6	27.5	
	8.30 p. m.	22	04	00	86	13	30		27.5	
	9.00 p. m.	22	06	00	86	11	00	25.0	27.5	
	9.30 p. m.	22	08	30	86	08	30		27.5	
	10.00 p. m.	22	11	30	86	06	00	25.0	27.5	
	10.30 p. m.	22	14	00	86	03	00		27.5	
	11.00 p. m.	22	18	00	86	01	00	25.0	27.5	
	11.30 p. m.	22	19	00	85	58	00		27.5	
	12.00 m.	22	21	30	85	55	30	25.0	26.7	
Nov. 24	12.30 a. m.	22	24	00	85	53	00		26.9	
	1.00 a. m.	22	26	00	85	51	00	24.4	26.9	
	1.30 a. m.	22	28	30	85	48	00		26.9	
	2.00 a. m.	22	31	00	85	45	00	24.4	26.7	
	2.30 a. m.	22	34	00	85	43	00		26.7	
	3.00 a. m.	22	36	00	85	40	00	23.9	27.0	
	3.30 a. m.	22	38	30	85	38	00		27.0	
	4.00 a. m.	22	42	00	85	34	30	23.9	27.0	
	4.30 a. m.	22	44	00	85	32	00		27.0	
	5.00 a. m.	22	46	00	85	30	00	23.9	27.0	
	5.30 a. m.	22	48	00	85	27	00		27.0	
	6.00 a. m.	22	51	00	85	24	00	23.9	26.9	
	6.30 a. m.	22	54	00	85	21	00		26.9	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1919.		°	′	″	°	′	″			
Nov. 24	7.00 a. m.	22	57	00	85	18	30	23.9	27.0	
	7.30 a. m.	22	59	00	85	15	30		27.0	
	8.00 a. m.	23	02	30	85	12	00	24.4	27.0	
	8.30 a. m.	23	05	00	85	09	30		27.5	
	9.00 a. m.	23	08	30	85	06	00	25.0	27.5	
	9.30 a. m.	23	11	00	85	03	30		27.8	
	10.00 a. m.	23	14	00	85	00	00	25.6	27.5	
	10.30 a. m.	23	17	00	84	57	00		27.5	
	11.00 a. m.	23	20	30	84	53	00	28.3	27.5	
	11.30 a. m.	23	24	00	84	49	00		27.5	
	12.00 m.	23	27	00	84	46	00	28.3	27.0	
	12.30 p. m.	23	30	00	84	42	00		27.5	
	1.00 p. m.	23	33	00	84	39	00	28.3	27.5	
	1.30 p. m.	23	36	30	84	35	30		27.5	
	2.00 p. m.	23	39	30	84	32	00	27.0	27.5	
	2.30 p. m.	23	43	30	84	28	00		27.5	
	3.00 p. m.	23	45	00	84	25	00	27.0	27.5	
										C20028.
	9.00 p. m.	23	45	00	84	13	00	25.0	27.0	
	9.30 p. m.	23	47	00	84	11	00		27.0	
	10.00 p. m.	23	49	00	84	08	00	24.4	27.0	
	10.30 p. m.	23	51	00	84	05	30		27.0	
	11.00 p. m.	23	53	00	84	02	30	24.4	26.9	
	11.30 p. m.	23	55	00	84	00	00		26.7	
	12.00 m.	23	57	00	83	57	00	24.4	26.7	
Nov. 25	2.30 a. m.	24	06	30	83	43	00		25.6	
	3.00 a. m.	24	08	30	83	40	30	26.1	25.3	
	3.30 a. m.	24	10	30	83	37	00		25.0	
	4.00 a. m.	24	12	30	83	34	30	26.1	25.3	
	4.30 a. m.	24	14	30	83	31	30		25.0	
	5.00 a. m.	24	16	00	83	29	00	23.3	25.0	
	5.30 a. m.	24	18	00	83	26	30		25.0	
	6.00 a. m.	24	19	30	83	23	30	23.3	25.3	
	6.30 a. m.	24	21	00	83	21	00		25.6	
										C20029.
	10.00 a. m.	24	27	30	83	08	00	26.1	25.8	
	10.30 a. m.	24	30	00	83	04	00		25.6	
Nov. 26										C20030.
										C20031.
Nov. 30	12.00 m.	24	27	00	81	43	00	27.8	26.1	
	1.00 p. m.	24	24	30	81	35	00	28.8	26.7	
	2.00 p. m.	24	25	00	81	29	00	32.2	26.7	
	3.00 p. m.	24	27	00	81	19	00	31.1	26.7	
	4.00 p. m.	24	29	00	81	09	00	29.4	26.7	
	5.00 p. m.	24	34	00	80	57	00	27.0	26.9	
	6.00 p. m.	24	38	00	80	47	00	26.7	26.9	
	7.00 p. m.	24	44	00	80	36	00	26.7	26.9	
	8.00 p. m.	24	50	00	80	27	00	26.7	26.7	
	9.00 p. m.	24	57	00	80	19	00	25.6	26.4	
	10.00 p. m.	25	03	30	80	11	30	25.6	26.4	
	11.00 p. m.	25	10	00	80	06	00	26.1	26.7	
	12.00 m.	25	16	30	80	04	00	26.1	26.7	
Dec. 1	1.00 a. m.	25	24	00	80	02	00	26.1	26.7	
	2.00 a. m.	25	31	00	79	59	00	25.6	26.7	
	3.00 a. m.	25	36	00	80	00	00	25.6	26.7	
	4.00 a. m.	25	39	30	80	01	00	25.6	26.7	
	5.00 a. m.	25	42	00	80	03	00	23.9	26.4	
	6.00 a. m.	25	44	00	80	03	30	23.9	26.4	
	7.00 a. m.		(a)			(a)		24.4	25.6	
	8.00 a. m.		(a)			(a)		24.4	25.0	
	9.00 a. m.		(a)			(a)		24.4	25.0	
	10.00 a. m.		(a)			(a)		24.4	25.0	
	11.00 a. m.		(a)			(a)		21.1	25.0	
	12.00 m.		(a)			(a)		24.7	24.7	
	1.00 p. m.		(a)			(a)		21.1	24.7	
	2.00 p. m.		(a)			(a)		23.9	24.7	
	3.00 p. m.		(a)			(a)		23.9	24.7	
	4.00 p. m.		(a)			(a)		23.9	24.7	
	5.00 p. m.		(a)			(a)		23.9	25.0	
	6.00 p. m.		(a)			(a)		23.9	25.0	
	7.00 p. m.		(a)			(a)		23.3	25.0	
	8.00 p. m.		(a)			(a)		23.3	25.0	
	9.00 p. m.		(a)			(a)		23.3	25.0	

[a] (Chart C. S. 166.) Fowey Rocks Lt. bears S8E., distant 10.4 mi. Rt. tang. Virginia Key S62¾W. distant 1.6 mi.

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.	Longitude.	Temperature (°C.).		Stations between which taken.
				Air.	Surface.	
1919.		° ′ ″	° ′ ″			
Dec. 1	10.00 p. m.	(a)	(a)	23.3	25.0	
	11.00 p. m.	(a)	(a)	23.3	25.0	
	12.00 m.	(a)	(a)	23.3	25.0	
Dec. 3	11.00 a. m.	25 51 00	80 07 00	26.7	25.6	
	12.00 m.	25 59 00	80 04 30	26.7	25.6	
	1.00 p. m.	26 08 00	80 02 00	26.1	25.3	
	2.00 p. m.	26 17 00	80 00 00	25.6	25.8	
	3.00 p. m.	26 24 00	79 59 30	25.6	24.4	
	4.00 p. m.	26 30 30	79 59 00	25.6	25.6	
	5.00 p. m.	26 37 00	79 58 30	25.0	25.6	
	6.00 p. m.	26 44 00	79 58 00	24.4	25.0	
	7.00 p. m.	26 51 00	79 57 00	23.9	25.5	
	8.00 p. m.	26 56 00	79 56 30	23.9	25.0	
	9.00 p. m.	27 03 00	79 58 00	23.3	25.0	
	10.00 p. m.	27 10 00	80 00 00	23.3	24.4	
	11.00 p. m.	27 17 00	80 02 00	22.8	23.9	
	12.00 m.	27 24 00	80 04 00	22.8	23.3	
Dec. 4	1.00 a. m.	27 31 00	80 05 30	22.8	23.0	
	2.00 a. m.	27 38 00	80 07 00	22.8	23.3	
	3.00 a. m.	27 45 00	80 09 00	22.8	22.2	
	4.00 a. m.	27 52 00	80 13 00	22.2	22.8	
	5.00 a. m.	27 58 20	80 17 00	22.2	23.3	
	6.00 a. m.	28 05 00	80 21 00	21.1	23.6	
	7.00 a. m.	28 11 30	80 25 00	21.7	23.6	
	8.00 a. m.	28 18 00	80 29 00	21.7	23.6	
	9.00 a. m.	28 24 30	80 33 00	23.3	21.9	
	....	....	....	....	....	C20032
	12.00 m.	28 25 00	80 32 00	25.0	21.9	
	1.00 p. m.	28 26 00	80 24 00	22.8	22.2	
	2.00 p. m.	28 33 00	80 23 00	23.3	22.2	
	3.00 p. m.	28 39 00	80 22 00	24.4	22.2	
	4.00 p. m.	28 45 00	80 27 00	23.3	21.7	
	5.00 p. m.	28 51 00	80 32 00	21.7	21.7	
	6.00 p. m.	28 56 30	80 37 00	20.6	21.7	
	7.00 p. m.	29 02 30	80 42 30	20.0	21.7	
	8.00 p. m.	29 08 30	80 48 00	20.0	21.7	
	9.00 p. m.	29 15 30	80 51 00	19.4	21.1	
	10.00 p. m.	29 22 00	80 53 30	19.4	21.1	
	11.00 p. m.	29 28 30	80 56 30	18.9	20.6	
	12.00 m.	29 35 00	80 59 30	18.9	20.6	
Dec. 5	1.00 a. m.	29 42 00	81 03 00	18.3	20.6	
	2.00 a. m.	29 49 00	81 06 00	17.8	20.0	
	3.00 a. m.	29 56 00	81 09 00	17.2	20.0	
	4.00 a. m.	30 03 00	81 11 30	16.7	20.0	
	5.00 a. m.	30 10 00	81 14 30	16.1	19.4	
	6.00 a. m.	30 18 00	81 17 30	15.0	19.4	
	7.00 a. m.	30 24 00	81 20 00	14.4	19.4	
	8.00 a. m.	30 31 00	81 21 00	12.2	18.3	
	9.00 a. m.	30 38 00	81 21 00	11.7	18.3	
	10.00 a. m.	30 44 30	81 22 00	11.1	17.8	
	....	....	....	....	....	C20033.
Dec. 8	....	....	....	....	....	C20034.
	1.00 p. m.	30 47 00	81 19 00	22.2	18.9	
	2.00 p. m.	30 51 00	81 12 00	22.8	18.9	
	3.00 p. m.	30 55 00	81 05 00	22.2	19.2	
	4.00 p. m.	30 59 00	80 57 30	22.2	19.4	
	5.00 p. m.	31 03 00	80 50 30	22.8	19.4	
	6.00 p. m.	31 07 30	80 43 30	22.8	18.9	
	7.00 p. m.	31 12 00	80 36 00	22.8	18.9	
	8.00 p. m.	31 16 00	80 29 00	22.8	18.9	
	9.00 p. m.	31 20 30	80 22 00	22.2	20.0	
	10.00 p. m.	31 24 30	80 15 00	21.7	20.0	
	11.00 p. m.	31 29 00	80 08 00	22.2	20.0	
	12.00 m	31 33 00	80 01 00	22.2	20.0	
Dec. 9	1.00 a. m.	31 37 00	79 54 00	22.8	20.0	
	2.00 a. m.	31 41 30	79 46 00	23.9	20.0	
	3.00 a. m.	31 46 00	79 39 30	23.9	20.0	
	4.00 a. m.	31 50 00	79 32 00	23.9	20.0	
	5.00 a. m.	31 54 00	79 25 00	24.4	23.3	
	6.00 a. m.	31 59 00	79 17 30	23.9	23.3	
	7.00 a. m.	32 03 00	79 10 00	23.3	23.0	
	....	....	....	....	....	C20035.
	2.00 p. m.	32 13 30	79 05 00	23.3	24.7	

[a] (Chart C. S. 166.) Fowey Rocks Lt. bears S8E., distant 10.4 mi. Rt. tang. Virginia Key S62¾W. distant 1.6 mi.

Surface Temperatures Taken While Under Way During Atlantic Cruises, South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1919.		°	′	″	°	′	″			
Dec. 9	3.00 p.m.	32	22	00	79	09	00	21.7	24.7	
	4.00 p.m.	32	30	00	79	13	00	21.1	24.7	
	5.00 p.m.	32	36	30	79	12	00	22.2	24.7	
	6.00 p.m.	32	48	30	79	07	30	21.7	21.9	
	7.00 p.m.	33	00	00	79	03	00	22.2	17.8	
	8.00 p.m.	33	06	30	78	56	00	21.7	17.8	
	9.00 p.m.	33	13	00	78	48	00	21.7	17.8	
	10.00 p.m.	33	19	00	78	41	30	21.7	17.5	
	11.00 p.m.	33	25	00	78	34	30	21.1	17.5	
	12.00 m.	33	31	00	78	28	00	21.1	17.2	
Dec. 10	1.00 a.m.	33	37	30	78	20	30	19.4	17.2	
	2.00 a.m.	33	43	00	78	14	00	18.9	17.2	
	3.00 a.m.	33	49	00	78	07	00	18.9	17.2	
										C20036.
Dec. 12	8.00 a.m.	33	49	30	78	03	00	10.0	14.4	
	9.00 a.m.	33	42	00	77	58	30	10.0	14.4	
	10.00 a.m.	33	37	00	77	53	30	16.7	17.2	
	11.00 a.m.	33	34	00	77	45	00	20.0	17.2	
	12.00 m.	33	34	00	77	35	30	20.0	17.2	
	1.00 p.m.	33	34	00	77	26	00	22.8	21.7	
	2.00 p.m.	33	34	00	77	17	00	23.3	21.7	
	3.00 p.m.	33	34	00	77	08	00	23.9	22.2	
	4.00 p.m.	33	34	00	76	58	00	23.9	22.2	
	5.00 p.m.	33	34	00	76	49	00	23.9	22.2	
										C20037.
	10.00 p.m.	33	49	00	76	40	30	23.9	22.8	
	11.00 p.m.	33	58	00	76	40	00	23.9	22.8	
	12.00 m.	34	06	45	76	39	00	23.9	22.8	
Dec. 13	1.00 a.m.	34	15	00	76	38	00	22.2	22.8	
	2.00 a.m.	34	24	00	76	37	30	20.6	22.8	
										C20038.
	12.00 m.	34	29	00	76	31	30	17.2	11.7	
	1.00 p.m.	34	26	00	76	26	30	18.9	16.1	
	2.00 p.m.	34	26	00	76	18	00	18.9	17.2	
	3.00 p.m.	34	26	00	76	09	30	19.4	17.8	
	4.00 p.m.	34	26	00	76	01	00	22.2	17.8	
	5.00 p.m.	34	26	00	75	52	00	21.7	20.0	
										C20039.
	12.00 m.	34	55	00	75	13	00	23.3	23.3	
Dec. 14	1.00 a.m.	35	04	00	75	05	30	22.2	22.8	
	2.00 a.m.	35	11	00	75	16	00	18.9	15.0	
										20040.
	2.00 p.m.	35	23	00	75	24	00	10.0	11.1	
	3.00 p.m.	35	29	00	75	23	00	9.4	10.0	
	4.00 p.m.	35	34	00	75	22	00	9.4	10.0	
	5.00 p.m.	35	37	30	75	22	00	7.2	9.4	
	6.00 p.m.	35	41	00	75	23	00	6.7	9.4	
	7.00 p.m.	35	44	00	75	24	00	6.1	8.9	
	8.00 p.m.	35	48	00	75	24	30	6.1	8.9	
	9.00 p.m.	35	51	00	75	25	00	5.0	11.1	
	10.00 p.m.	35	57	00	75	27	00	5.0	10.6	
	11.00 p.m.	36	02	30	75	28	00	4.4	10.6	
	12.00 m.	36	07	30	75	30	00	3.9	9.4	
Dec. 15	1.00 a.m	36	13	00	75	31	00	3.9	9.4	
	2.00 a.m.	36	18	00	75	32	30	3.9	8.3	
	3.00 a.m.	36	23	00	75	34	00	3.9	8.3	
	4.00 a.m.	36	27	00	75	35	00	1.7	8.9	
	5.00 a.m.	36	31	20	75	36	00	1.1	8.9	
	6.00 a.m.	36	35	30	75	37	00	.6	8.3	
	7.00 a.m	36	42	30	75	45	00	.5	7.8	
	8.00 a.m.	36	44	30	75	52	30	.5	7.2	
1920.										
Feb. 19	6.00 p.m.	37	15	00	75	29	00	4.4	3.6	
	7.00 p.m.	37	19	00	75	19	30	3.3	3.6	
	8.00 p.m.	37	23	00	75	10	00	3.3	3.6	
	9.00 p.m.	37	27	00	75	00	00	2.2	3.6	
	10.00 p.m.	37	31	30	74	51	00	1.7	3.6	
	11.00 p.m.	37	35	30	74	41	00	1.1	3.0	
	12.00 m.	37	40	00	74	31	00	.6	3.0	
Feb. 20	1.00 a.m.	37	43	30	74	22	00	.6	3.0	
	2.00 a.m.	37	48	00	74	12	00	.6	3.0	
										C20041.
	8.00 a.m.	37	54	00	73	58	30	.0	3.0	
	9.00 a.m.	37	59	00	73	51	30	.0	4.4	
	10.00 a.m.	38	04	00	73	48	00	2.8	5.0	
	11 00 a.m.	38	09	00	73	44	30	2.8	5.0	

Surface Temperatures Taken While Under Way During Atlantic Cruises, South from Norfolk, 1919, and North from Norfolk, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1920.		°	′	″	°	′	″			
Feb. 20	12.00 m.	38	14	00	73	40	00	3.9	5.3	
	1.00 p. m.	38	19	00	73	35	00	.6	3.9	
	2.00 p. m.	38	24	00	73	31	00	.0	3.9	
	3.00 p. m.	38	29	00	73	26	00	1.1	3.9	
	4.00 p. m.	38	34	00	73	21	00	1.1	3.3	
	5.00 p. m.	38	39	00	73	16	30	2.2	3.3	
	6.00 p. m.	38	44	00	73	12	00	1.7	3.3	
	7.00 p. m.	38	49	00	73	07	00	1.1	3.0	
	8.00 p. m.	38	54	00	73	03	00	.6	2.8	
	9.00 p. m.	38	59	00	72	58	00	2.2	2.8	
Feb. 20 to 21										C20042.
Feb. 21	2.00 a. m.	39	09	00	72	40	00	3.3	5.6	
	3.00 a. m.	39	14	00	72	33	00	2.8	5.3	
	4.00 a. m.	39	20	00	72	26	00	2.2	5.3	
	5.00 a. m.	39	25	00	72	19	00	2.2	5.0	
	6.00 a. m.	39	30	30	72	12	00	1.7	5.0	
	7.00 a. m.	39	35	30	72	05	30	1.7	5.0	
										C20043.
	12.00 m.	39	35	00	71	50	30	5.6	5.6	
	1.00 p. m.	39	36	30	71	41	00	7.2	6.1	
	2.00 p. m.	39	38	00	71	31	00	6.7	7.8	
	3.00 p. m.	39	39	00	71	21	30	5.0	7.2	
	4.00 p. m.	39	41	00	71	12	00	3.9	5.0	
	5.00 p. m.	39	42	00	71	02	00	2.2	5.0	
	6.00 p. m.	39	43	00	70	52	00	2.2	5.0	
	7.00 p. m.	39	45	00	70	42	30	2.2	5.0	
	8.00 p. m.	39	46	00	70	32	30	2.8	5.0	
	9.00 p. m.	39	47	30	70	22	30	3.3	5.0	
	10.00 p. m.	39	49	00	70	13	00	3.3	5.0	
	11.00 p. m.	39	50	00	70	03	00	3.9	5.0	
	12.00 m.	39	51	30	69	53	00	3.9	5.0	
Feb. 22	1.00 a. m.	39	53	00	69	44	00	5.6	5.0	
	2.00 a. m.	39	54	00	69	34	00	5.6	5.0	
	3.00 a. m.	39	56	00	69	24	00	5.6	4.4	
	4.00 a. m.	39	57	00	69	15	00	6.1	5.0	
	5.00 a. m.	39	58	00	69	05	00	6.7	5.0	
	6.00 a. m.	40	00	00	68	50	00	7.2	4.7	
	7.00 a. m.	40	01	00	68	45	30	7.2	4.4	
	8.00 a. m.	40	02	30	68	36	00	7.2	4.4	
	9.00 a. m.	40	04	00	68	26	00	8.3	4.4	
	10.00 a. m.	40	05	00	68	16	00	8.3	4.4	
	11.00 a. m.	40	06	30	68	06	00	8.3	4.4	
										C20044.
										C20045.
	8.00 p. m.	40	21	00	68	11	00	5.0	5.0	
	9.00 p. m.	40	28	30	68	15	00	4.4	5.0	
										C20046.
	12.00 m.	40	40	30	68	22	00	3.3	5.0	
Feb. 23	1.00 a. m.	40	46	30	68	24	00	3.3	5.0	
	2.00 a. m.	40	53	00	68	27	30	3.3	5.0	
	3.00 a. m.	41	00	00	68	30	30	2.8	5.0	
	4.00 a. m.	41	06	00	68	33	00	2.2	5.0	
										C20047.
	7.00 a. m.	41	16	30	68	38	00	3.3	4.4	
	8.00 a. m.	41	23	00	68	41	00	2.8	4.4	
	9.00 a. m.	41	29	00	68	44	00	2.2	3.9	
	10.00 a. m.	41	36	00	68	47	00	2.2	3.6	
										C20048
	1.00 p. m.	41	44	00	68	54	00	2.8	3.3	
	2.00 p. m.	41	49	00	69	03	00	2.8	3.3	
	3.00 p. m.	41	54	00	69	12	00	2.2	2.8	
	4.00 p. m.	41	59	00	69	21	00	2.2	2.8	
	5.00 p. m.	42	04	00	69	30	00	2.2	2.8	
	6.00 p. m.	42	07	00	69	40	30	2.2	3.3	
	7.00 p. m.	42	09	00	69	51	00	2.2	3.3	
	8.00 p. m.	42	14	00	69	52	00	2.2	3.3	
	9.00 p. m.	42	22	00	69	43	00	2.2	3.3	
										C20049.
Feb. 24	1.00 a. m.	42	28	00	69	47	30	2.8	3.3	
	2.00 a. m.	42	26	00	70	01	00	2.8	3.3	
	3.00 a. m.	42	24	00	70	14	00	3.3	3.3	
	4.00 a. m.	42	21	00	70	27	00	3.3	3.3	
	5.00 a. m.	42	19	00	70	40	00	3.3	3.3	
										[Boston].

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.	Longitude.	Temperature (°C.). Air.	Temperature (°C.). Surface.	Stations between which taken.
1920.		° ′ ″	° ′ ″			
Mar. 1	12.00 m.	42 21 30	70 43 30	6.7	1.1	
	1.00 p. m.	42 25 00	70 32 00	8.3	1.1	
	2.00 p. m.	42 28 00	70 23 00	8.9	1.1	
	....	....	....	....	....	C20050.
Mar. 1 to 2	....	....	....	....	....	C20051.[a]
Mar. 2	....	....	....	....	....	C20052.
	10.00 p. m.	42 44 00	68 33 30	3.3	2.8	
	11.00 p. m.	42 44 00	68 24 00	2.2	2.8	
	12.00 m.	42 44 00	68 15 00	1.1	2.8	
Mar. 3	1.00 a. m.	42 44 00	68 05 30	.5	2.8	
	2.00 a. m.	42 44 00	67 56 00	.5	2.8	
	3.00 a. m.	42 44 00	67 47 00	.5	2.8	
	4.00 a. m.	42 44 00	67 37 00	.5	2.8	
	....	....	....	....	....	C20053.
	8.00 a. m.	42 49 00	67 30 00	.6	2.8	
	9.00 a. m.	42 58 00	67 34 00	1.7	3.0	
	10.00 a. m.	43 06 00	67 38 00	1.7	2.5	
	11.00 a. m.	43 14 00	67 42 00	3.9	2.2	
	....	....	....	....	....	C20054.
	3.00 p. m.	43 23 30	67 45 00	3.9	2.2	
	4.00 p. m.	43 31 00	67 48 00	3.9	2.2	
	5.00 p. m.	43 38 00	67 50 30	3.9	2.2	
	....	....	....	....	....	C20055.
	8.00 p. m.	43 47 30	67 55 00	3.9	2.2	
	9.00 p. m.	43 54 00	68 00 00	3.9	2.5	
	10.00 p. m.	44 01 00	68 05 00	3.3	2.2	
	....	....	....	....	....	C20056.
Mar. 4	1.00 a. m.	43 59 00	68 16 00	3.9	1.1	
	2.00 a. m.	43 53 00	68 24 00	4.4	1.1	
	3.00 a. m.	43 47 00	68 32 00	4.4	1.1	
	4.00 a. m.	43 42 00	68 40 00	4.4	1.1	
	5.00 a. m.	43 36 00	68 48 00	4.4	1.1	
	6.00 a. m.	43 29 00	68 53 30	4.4	....	
	7.00 a. m.	43 22 00	68 56 00	4.4	....	
	....	....	....	....	....	C20057.
	9.00 a. m.	43 21 30	68 59 00	4.4	1.1	
	10.00 a. m.	43 26 00	69 08 00	5.0	1.1	
	11.00 a. m.	43 30 30	69 18 00	5.0	1.1	
	12.00 m.	43 35 30	69 28 00	4.4	1.1	
	....	....	....	....	....	C20058.
	3.00 p. m.	43 38 00	69 45 00	6.1	1.9	
	4.00 p. m.	43 34 00	69 53 00	6.1	1.1	
	5.00 p. m.	43 29 00	70 02 00	6.7	1.1	
	....	....	....	....	....	C20059.
	8.00 p. m.	43 18 00	70 16 00	5.6	1.1	
	9.00 p. m.	43 12 00	70 20 00	5.6	1.1	
	10.00 p. m.	43 05 00	70 25 00	5.6	1.1	
	....	....	....	....	....	C20060.
	12.00 m.	43 02 00	70 25 00	5.6	1.1	
Mar. 5	1.00 a. m.	43 01 00	70 15 00	6.1	1.7	
	....	....	....	....	....	C20061.
	4.00 a. m.	42 54 00	70 16 00	5.6	1.7	
	5.00 a. m.	42 47 30	70 22 00	6.1	1.7	
	6.00 a. m.	42 41 00	70 28 00	6.1	1.7	
	7.00 a. m.	42 35 00	70 34 00	6.1	1.7	
	8.00 a. m.	42 29 00	70 40 00	6.1	....	
	....	....	....	....	....	C20062.
....	....	....	....	....	....	[Boston.]
Mar. 10	12.00 m.	....	....	9.4	1.1	
	1.00 p. m.	42 19 00	70 35 30	11.7	1.1	
	2.00 p. m.	42 18 00	70 24 00	12.2	1.7	
	3.00 p. m.	42 17 00	70 12 30	9.4	1.7	
	4.00 p. m.	42 16 00	70 01 00	10.6	2.2	
	5.00 p. m.	42 15 00	69 49 00	10.6	2.2	
	6.00 p. m.	42 13 30	69 37 30	9.4	2.2	
	7.00 p. m.	42 12 30	69 26 00	8.9	2.2	
	8.00 p. m.	42 11 00	69 15 00	8.3	2.2	
	9.00 p. m.	42 10 00	69 03 00	7.2	2.2	
	10.00 p. m.	42 09 00	68 51 30	7.2	2.2	
	11.00 p. m.	42 08 00	68 40 00	7.2	2.2	
	12.00 m.	42 07 00	68 28 00	7.2	2.2	

[a] Temperatures discarded between stations 20051 and 20052.

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hours.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
								Air.	Surface.	
1920.		°	′	″	°	′	″			
Mar. 11	1.00 a. m.	42	06	00	68	16	30	6.7	....	
										C20063.
	4.00 a. m.	42	05	00	68	09	00	6.7	3.3	
	5.00 a. m.	42	07	00	67	59	30	6.7	3.3	
	6.00 a. m.	42	09	00	67	50	00	6.7	3.3	
	7.00 a. m.	42	11	00	67	40	00	7.2	3.3	
	8.00 a. m.	42	13	00	67	30	00	7.2	3.3	
	9.00 a. m.	42	15	00	67	20	00	9.4	3.9	
										C20064.
	1.00 p. m.	42	28	00	67	12	00	9.4	3.3	
	2.00 p. m.	42	13	00	67	08	00	8.9	....	
	3.00 p. m.	42	07	00	67	03	00	8.3	....	
	4.00 p. m.	42	02	00	66	59	00	7.8	....	
	5.00 p. m.	41	56	30	66	54	00	8.3	....	
										C20065.
	7.00 p. m.	41	49	00	66	51	00	8.3	....	
	8.00 p. m.	41	40	30	66	47	00	8.3	....	
										C20066.
Mar. 12	1.00 a. m.	41	26	00	66	39	00	9.4	....	
	2.00 a. m.	41	20	00	66	35	00	8.9	2.8	
										C20067.
	5.00 a. m.		(a)			(a)		9.4	2.8	
	6.00 a. m.		(a)			(a)		10.0	2.8	
	7.00 a. m.		(a)			(a)		9.4	2.8	
										C20068.
	10.00 a. m.	40	55	30	66	15	00	10.0	3.3	
	11.00 a. m.	40	49	00	66	10	00	11.1	3.3	
										C20069.
	2.00 p. m.	40	54	00	66	08	00	10.6	3.3	
	4.00 p. m.	41	01	00	66	08	00	10.0	3.3	
	5.00 p. m.	41	09	00	66	08	00	10.0	3.3	
	6.00 p. m.	41	17	00	66	08	00	9.4	3.3	
	7.00 p. m.	41	24	00	66	08	00	9.4	3.3	
	8.00 p. m.	41	32	00	66	08	00	9.4	3.3	
	9.00 p. m.	41	39	30	66	08	00	9.4	3.3	
	10.00 p. m.	41	47	00	66	08	00	9.4	3.3	
	11.00 p. m.	41	54	30	66	08	00	8.9	3.3	
	12.00 m.	42	02	00	66	08	00	10.0	3.3	
Mar. 13	1.00 a. m.	42	06	30	66	08	00	4.4	2.8	
										C20070.
	4.00 a. m.	42	11	00	66	09	00	10.0	2.8	
										C20071.
	7.00 a. m.	42	22	00	66	00	00	10.0	2.8	
	8.00 a. m.	42	33	00	65	52	00	10.0	....	
										C20072.
	10.00 a. m.	42	40	00	65	48	00	9.4	2.8	
	11.00 a. m.	42	48	00	65	45	00	9.4	2.8	
	12.00 m.	42	56	00	65	40	00	9.4	2.8	
	1.00 p. m.	43	04	00	65	36	00	9.4	2.8	
	2.00 p. m.	43	12	00	65	32	00	9.4	2.8	
	3.00 p. m.	43	20	00	65	27	00	10.0	2.8	
	4.00 p. m.	43	27	30	65	21	00	10.0	2.8	
	5.00 p. m.	43	35	00	65	15	00	10.6	2.8	
	6.00 p. m.		(b)			(b)		10.6	2.8	
	7.00 p. m.		(b)			(b)		11.1	2.8	
	8.00 p. m.		(b)			(b)		11.1	2.8	
	9.00 p. m.		(b)			(b)		12.2	2.8	
	10.00 p. m.		(b)			(b)		12.2	2.8	
	11.00 p. m.		(b)			(b)		12.2	2.8	
	12.00 m.		(b)			(b)		12.2	2.8	
Mar. 14	1.00 a. m.		(b)			(b)		7.2	2.8	
	2.00 a. m.		(b)			(b)		7.2	2.8	
	3.00 a. m.		(b)			(b)		7.2	2.8	
	4.00 a. m.		(b)			(b)		4.4	2.2	
	5.00 a. m.		(b)			(b)		4.4	2.2	
	6.00 a. m.		(b)			(b)		3.9	2.2	
	7.00 a. m.		(b)			(b)		2.2	....	
	8.00 a. m.		(b)			(b)		2.8	2.2	
	9.00 a. m.		(b)			(b)		2.2	2.2	
	10.00 a. m.		(b)			(b)		2.2	2.2	

[a] Position at this hour doubtful. Surface temperature 37° F. between stations 20067 (lat. 41° 15′, long. 66° 31′) and 20068 (lat. 41° 02′, long. 66° 20′).

[b] Anchorage, Shelburne Harbor, N. S.

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.	Longitude.	Temperature (°C.). Air.	Temperature (°C.). Surface.	Stations between which taken.
1920.		° ′ ″	° ′ ″			
Mar. 14	11.00 a. m.	(a)	(a)	1.7	2.2	
	12.00 m.	(a)	(a)	1.7	2.2	
	1.00 p. m.	(a)	(a)	2.2	2.2	
	2.00 p. m.	(a)	(a)	.6	2.2	
	3.00 p. m.	(a)	(a)	.6	2.2	
	4.00 p. m.	(a)	(a)	.6	2.2	
	5.00 p. m.	(a)	(a)	.6	2.2	
	6.00 p. m.	(a)	(a)	.0	2.2	
	7.00 p. m.	(a)	(a)	.0	2.2	
	8.00 p. m.	(a)	(a)	.5	2.2	
	9.00 p. m.	(a)	(a)	.6	2.2	
	10.00 p. m.	(a)	(a)	.0	2.2	
	11.00 p. m.	(a)	(a)	1.1	2.2	
	12.00 m.	(a)	(a)	1.1	2.2	
Mar. 15	1.00 a. m.	(a)	(a)	2.2	2.2	
	2.00 a. m.	(a)	(a)	2.2	1.7	
	3.00 a. m.	(a)	(a)	2.2	1.7	
	4.00 a. m.	(a)	(a)	2.2	1.7	
	5.00 a. m.	(a)	(a)	2.2	1.7	
	6.00 a. m.	(a)	(a)	2.2	1.7	
	7.00 a. m.	(a)	(a)	1.6	1.7	
	8.00 a. m.	(a)	(a)	1.1	1.7	
	9.00 a. m.	(a)	(a)	.5	1.7	
	10.00 a. m.	(a)	(a)	.5	1.1	
	11.00 a. m.	(a)	(a)	.0	1.1	
	12.00 m.	(a)	(a)	.6	1.1	
	1.00 p. m.	(a)	(a)	2.2	1.1	
	2.00 p. m.	(a)	(a)	4.4	1.1	
	3.00 p. m.	(a)	(a)	4.4	1.1	
	4.00 p. m.	(a)	(a)	4.4	1.1	
	5.00 p. m.	(a)	(a)	4.4	1.1	
	6.00 p. m.	(a)	(a)	4.4	1.1	
	7.00 p. m.	(a)	(a)	4.4	1.1	
	8.00 p. m.	(a)	(a)	3.9	1.1	
	9.00 p. m.	(a)	(a)	3.3	1.1	
	10.00 p. m.	(a)	(a)	1.1	1.1	
	11.00 p. m.	(a)	(a)	.5	1.1	
	12.00 m.	(a)	(a)	.5	1.1	
Mar. 17	12.00 m.	43 37 30	65 15 30	10.6	2.8	
						C20073.
	3.00 p. m.	43 34 00	65 11 00	10.0	2.8	
	4.00 p. m.	43 38 00	65 15 30	9.4	2.8	
						[Shelburne.]
Mar. 19	8.00 a. m.	43 32 00	65 08 30	21.6	2.8	
	9.00 a. m.	43 25 00	65 03 00	17.8	1.4	
						C20074.
	12.00 m.	43 14 00	64 54 00	15.6	.8	
	1.00 p. m.	43 07 00	64 47 00	4.4	.6	
	2.00 p. m.	42 59 00	64 40 00	3.9	.6	
						C20075.
	4.00 p. m.	42 53 00	64 36 30	3.9	.6	
	5.00 p. m.	42 45 00	64 34 00	3.3	.8	
	6.00 p. m.	42 36 30	64 31 00	2.8	.6	
						C20076.
	9.00 p. m.	42 30 00	64 26 30	4.4	1.1	
Mar. 19 to 20						C20077.
Mar. 20	1.00 a. m.	42 26 00	64 25 00	5.0	1.1	
	2.00 a. m.	42 30 00	64 36 00	5.0	1.1	
	3.00 a. m.	42 35 00	64 46 00	5.0	1.1	
	4.00 a. m.	42 38 30	64 57 00	4.4	1.1	
	5.00 a. m.	42 43 00	65 07 30	4.4	1.1	
	6.00 a. m.	42 47 00	65 18 00	4.4	....	
	7.00 a. m.	42 51 00	65 29 00	3.3	....	
	8.00 a. m.	42 55 00	65 39 00	2.8	....	
						C20078.
	11.00 a. m.	43 05 30	66 01 00	1.7	1.7	
	12.00 m.	43 12 00	66 10 00	2.8	1.7	
	1.00 p. m.	43 18 00	66 19 30	1.1	1.7	
	2.00 p. m.	43 24 00	66 29 00	1.1	2.2	
	3.00 p. m.	43 30 30	66 34 00	2.8	2.2	
	4.00 p. m.	43 36 30	66 34 00	3.5	2.5	
	5.00 p. m.	43 42 00	66 33 00	3.9	2.2	
	6.00 p. m.	43 46 30	66 27 00	3.9	2.2	
	7.00 p. m.	43 52 00	66 24 00	3.3	2.2	

[a] Anchorage, Shelburne Harbor, N. S.

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.	Longitude.	Temperature (°C.). Air.	Temperature (°C.). Surface.	Stations between which taken.
1920.		° ′ ″	° ′ ″			
Mar. 20	8.00 p. m.	43 58 00	66 24 00	3.8	1.7	
	9.00 p. m.	44 04 00	66 24 00	1.1	1.7	
	10.00 p. m.	44 06 30	66 19 00	1.1	1.7	
						[C. St. Mary.]
						[St. Mary Bay.]
Mar. 21	6.00 a. m.	44 10 30	66 16 30	1.1	.6	
	7.00 a. m.	44 16 00	66 17 00	1.1	.6	
Mar. 22	11.00 a. m.	44 09 00	66 29 00	9.44	1.67	
	12.00 m.	44 17 00	66 34 00	10.56	1.95	
						C20079.
	4.00 p. m.	44 21 00	66 49 00	7.22	2.5	
	5.00 p. m.	44 21 00	67 00 00	6.11	2.22	
	6.00 p. m.	44 21 00	67 12 00	6.11	2.22	
	7.00 p. m.	44 21 00	67 23 00	6.11	2.5	
						C20080.
	10.00 p. m.	44 16 00	67 33 00	5.56	....	
	11.00 p. m.	44 09 00	67 27 00	5.56	1.95	
Mar. 22 to 23						C20081.
Mar. 23	2.00 a. m.	44 05 00	67 19 00	6.11	1.67	
	3.00 a. m.	44 01 30	67 10 00	6.11	1.67	
	4.00 a. m.	47 57 00	67 01 00	6.11	1.67	
						C20082.
	7.00 a. m.	43 51 00	66 43 00	7.22	2.22	
	8.00 a. m.	43 47 00	66 30 30	7.22	2.22	
						C20083.
	11.00 a. m.	43 35 30	66 18 00	7.78	1.95?	
	12.00 m.	43 30 00	66 15 00	7.78	....	
	1.00 p. m.	43 24 00	66 12 00	8.33	2.22	
						C20084.
	4.00 p. m.	43 18 00	66 20 00	9.44	....	
	5.00 p. m.	43 17 00	66 30 00	8.89	....	
						C20085.
	7.00 p. m.	43 15 00	66 45 00	8.89	....	
	8.00 p. m.	43 13 00	66 51 00	8.89	....	
	9.00 p. m.	43 11 00	67 07 00	8.33	3.5?	
						C20086.
	12.00 m.	43 18 00	67 17 00	7.78	2.5	
Mar. 24	1.00 a. m.	43 10 00	67 25 00	7.78	2.5	
	2.00 a. m.	43 02 30	67 33 00	7.78	2.22	
	3.00 a. m.	42 59 00	67 40 00	7.22	2.22	
	4.00 a. m.	42 56 00	67 48 00	7.22	2.22	
	5.00 a. m.	42 53 00	67 56 00	7.22	2.22	
	6.00 a. m.	42 50 30	68 04 00	7.22	2.22	
	7.00 a. m.	42 47 00	68 13 00	8.89	2.5	
	8.00 a. m.	42 44 00	68 20 00	8.89	2.5	
	9.00 a. m.	42 41 00	68 28 00	12.22	3.05	
	10.00 a. m.	42 41 00	68 37 00	12.22	3.05	
	11.00 a. m.	42 40 00	68 46 00	12.22	3.05	
	12.00 m.	42 39 00	68 55 00	11.67	3.05	
	1.00 p. m.	42 38 00	69 04 00	11.11	4.44	
	2.00 p. m.	42 38 00	69 13 00	11.11	3.89	
	3.00 p. m.	42 37 00	69 21 00	11.67	3.33	
						C20087.
	6.00 p. m.	42 34 00	69 31 00	8.33	2.5	
	7.00 p. m.	42 28 00	69 38 00	8.33	2.5	
	8.00 p. m.	42 23 00	69 45 00	8.33	2.22	
	9.00 p. m.	42 17 00	69 51 00	8.33	2.22	
						C20088.
	12.00 m.	42 16 00	70 09 00	7.22	2.22	
Mar. 25	1.00 a. m.	42 18 00	70 24 00	6.67	2.22	
	2.00 a. m.	42 19 00	70 31 00	6.67	2.5	
	3.00 a. m.	42 20 00	70 39 00	6.11	2.78	
						[Boston.]
Apr. 6	3.00 p. m.	42 25 00	70 44 30	6.11	3.33	
						C20089.
	5.00 p. m.	42 31 00	70 41 30	5.00	2.78	
Apr. 9 and 10						C20090 to C20096, inclusive.[a]
Apr. 10	6.00 p. m.	43 45 00	69 38 00	7.22	2.22	
	7.00 p. m.	43 40 00	69 29 30	6.11	2.22	
	8.00 p. m.	43 35 00	69 20 30	5.00	....	
	9.00 p. m.	43 29 30	69 12 00	4.44	....	
	10.00 p. m.	43 24 00	69 03 00	4.44	....	

[a] Temperatures discarded between these stations.

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
		°	′	″	°	′	″	Air.	Surface.	
1920.										
Apr. 10 to 11										C20097.
Apr. 11	2.00 a. m.	43	21	30	68	41	00	6.11	....	
	3.00 a. m.	43	29	30	68	31	00	6.11	....	
	4.00 a. m.	43	32	30	68	21	00	6.11	....	
	5.00 a. m.	43	35	30	68	12	30	6.11	....	
	6.00 a. m.	43	39	30	68	03	30	6.11	....	
										C20098.
	10.00 a. m.	43	46	30	67	56	30	3.89	3.33	
	11.00 a. m.	43	51	30	68	59	00	11.11	3.33	
	12.00 m.	44	02	30	68	02	00	15.00	3.33	
	1.00 p. m.	44	10	30	68	03	30	15.56	3.33	
	2.00 p. m.	44	18	30	68	07	00	15.56	3.33	
										[Bar Harbor.]
Apr. 12	12.00 m.	44	18	00	68	01	00	6.67	2.78	
										C20099.
	3.00 p. m.	44	13	00	67	42	00	8.89	3.89	
	4.00 p. m.	44	10	00	67	31	00	8.33	3.89	
										C20100.
	7.00 p. m.	44	05	00	67	15	00	7.78	2.78	
	8.00 p. m.	44	00	00	67	05	00	7.22	2.78	
	9.00 p. m.	43	55	00	66	55	00	6.67	2.78	
										C20101.
	11.00 p. m.	43	53	00	66	48	00	7.78	4.17	
	12.00 m.	43	49	00	66	40	00	7.78	3.89	
Apr. 13	1.00 a. m.	43	46	00	66	32	00	7.22	3.89	
										C20102.
										[Yarmouth.]
Apr. 15	9.00 a. m.	43	47	00	66	09	00	10.00	3.89	
	10.00 a. m.	43	40	00	66	16	00	10.00	3.89	
	11.00 a. m.	43	34	00	66	22	00	9.44	3.89	
	12.00 m.	43	27	00	66	29	00	10.00	3.89	
										C20103.
	3.00 p. m.	43	18	00	66	26	00	8.89	3.89	
	4.00 p. m.	43	16	00	66	17	00	8.89	3.89	
	5.00 p. m.	43	14	00	66	08	00	8.33	3.61	
										C20104.
	8.00 p. m.	43	06	00	65	59	00	7.22	3.33	
										C20105.
	11.00 p. m.	42	53	00	65	59	00	8.33	3.33	
	12.00 m.	42	44	00	66	01	00	8.33	3.33	
Apr. 16										C20106.
	2.00 a. m.	42	36	00	66	01	00	7.22	....	
	3.00 a. m.	42	29	00	66	02	00	7.22	....	
	4.00 a. m.	42	22	00	66	02	00	7.22	....	
										C20107.
	7.00 a. m.	42	11	00	66	03	00	10.00	3.89	
	8.00 a. m.	42	04	00	66	04	00	10.56	3.89	
										C20108.
	10.00 a. m.	41	55	00	66	05	00	10.56	4.17	
	11.00 a. m.	41	50	00	66	05	30	11.67	4.17	
	12.00 m.	41	44	00	66	06	00	11.67	4.17	
	1.00 p. m.	41	39	00	66	06	30	9.44	4.17	
	2.00 p. m.	41	33	00	66	07	00	10.00	4.17	
	3.00 p. m.	41	28	00	66	08	00	10.00	4.17	
	4.00 p. m.	41	22	00	66	08	00	10.00	4.17	
										C20109.
	7.00 p. m.	41	25	00	66	16	00	11.11	3.89	
										C20110.
	10.00 p. m.	41	40	00	66	28	00	8.89	3.89	
	11.00 p. m.	41	46	00	66	32	00	8.33	3.89	
	12.00 m.	41	52	00	66	38	00	7.78	3.89	
Apr. 17										C20111.
	3.00 a. m.	42	03	00	66	46	00	7.22	3.89	
	4.00 a. m.	42	10	00	66	52	00	7.22	3.89	
	5.00 a. m.	42	18	00	66	59	00	7.22	3.89	
										C20112.
	8.00 a. m.	42	25	00	67	05	00	7.78	....	
	9.00 a. m.	42	30	00	67	12	00	8.33	3.61	
	10.00 a. m.	42	36	00	67	18	00	8.89	3.61	
	11.00 a. m.	42	42	00	67	24	00	8.89	3.61	
	12.00 m.	42	47	00	67	31	00	8.33	3.61	
										C20113.
	3.00 p. m.	42	52	00	67	43	00	7.22	3.33	
	4.00 p. m.	42	50	00	67	54	00	6.67	3.33	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.			Longitude.			Temperature (°C.).		Stations between which taken.
		°	′	″	°	′	″	Air.	Surface.	
1920.										
Apr. 17	5.00 p. m.	42	47	00	68	06	00	7.22	3.33	
	6.00 p. m.	42	45	00	68	17	00	7.22	3.33	
	7.00 p. m.	42	43	00	68	29	00	7.22	3.33	
										C20114.
	10.00 p. m.	42	42	00	68	46	00	7.22	3.05	
	11.00 p. m.	42	44	00	68	58	00	7.22	3.33	
	12.00 m.	42	47	00	69	11	00	7.22	3.33	
Apr. 18	1.00 a. m.	42	44	00	69	12	00	6.67	3.33	
	2.00 a. m.	42	39	00	69	18	00	6.11	3.33	
	3.00 a. m.	42	37	00	69	28	00	6.11	3.33	
										C20115.
	6.00 a. m.	42	32	00	69	38	00	6.67	3.33	
	7.00 a. m.	42	24	00	69	45	00	6.67	....	
	8.00 a. m.	42	16	00	69	51	30	6.11	....	
	9.00 a. m.	42	09	00	69	45	00	6.11	....	
										C20116.
	12.00 m.	42	06	00	69	48	00	7.78	3.33	
										C20117.
	3.00 p. m.	42	07	30	70	09	00	8.89	3.05	
	4.00 p. m.	42	04	00	70	17	00	8.89	3.05	
										[Provincetown.]
Apr. 20										C20118.
May 16	10.00 a. m.	42	26	00	70	41	00	20.0	8.89	
										C20123.
	1.00 p. m.	42	28	00	70	35	00	20.0	10.00	
										C20124.
	8.00 p. m.	42	10	00	69	57	00	13.3	8.90	
	9.00 p. m.	42	05	00	69	52	00	10.6	9.2	
										C20125.
	12.00 m.	41	53	00	69	39	00	12.8	8.3	
May 17	1.00 a. m.	41	47	00	69	32	00	12.8	8.3	
	2.00 a. m.	41	40	00	69	24	00	12.8	8.3	
										C20126.
	4.00 a. m.	41	35	00	69	20	00	12.8	8.3	
	5.00 a. m.	41	28	00	69	13	00	12.8	8.3	
										C20127.
	8.00 a. m.	41	17	00	69	03	00	15.0	8.3	
	9.00 a. m.	41	09	00	69	02	00	13.3	7.8	
										C20128.
	5.00 p. m.	40	27	00	68	55	00	13.9	8.9	
	6.00 p. m.	40	18	00	68	58	00	12.8	8.3	
	7.00 p. m.	40	09	00	69	02	00	12.2	8.3	
										C20129.
	10.00 p. m.	40	01	00	69	12	00	11.7	7.8	
	11.00 p. m.	39	57	00	69	21	00	12.2	7.5	
	12.00 m.	39	53	00	69	31	00	12.2	7.8	
May 18	1.00 a. m.	39	49	00	69	40	00	12.2	7.8	
	2.00 a. m.	39	45	00	69	49	00	12.2	7.8	
	3.00 a. m.	39	40	00	69	58	00	12.8	7.8	
	4.00 a. m.	39	36	00	70	08	00	12.8	8.3	
	5.00 a. m.	39	32	00	70	17	00	14.4	8.9	
	6.00 a. m.	39	28	00	70	26	00	17.2	8.9	
	7.00 a. m.	39	24	00	70	34	00	17.8	8.9	
	8.00 a. m.	39	20	00	70	44	00	19.4	10.0	
	9.00 a. m.	39	16	00	70	53	00	20.0	10.6	
	10.00 a. m.	39	12	00	71	02	00	15.0	11.1	
	11.00 a. m.	39	08	00	71	11	00	20.0	11.1	
	12.00 m.	39	04	00	71	20	00	20.6	12.8	
	1.00 p. m.	38	59	00	71	30	00	20.6	12.8	
	2.00 p. m.	38	55	00	71	39	00	20.6	12.8	
	3.00 p. m.	38	50	00	71	47	00	20.6	12.8	
	4.00 p. m.	38	46	00	71	57	00	20.0	12.8	
	5.00 p. m.	38	42	00	72	06	00	20.0	13.0	
	6.00 p. m.	38	38	00	72	15	00	18.3	13.9	
	7.00 p. m.	38	34	00	72	24	00	17.8	13.9	
	8.00 p. m.	38	30	00	72	34	00	16.7	12.5	
	9.00 p. m.	38	26	00	72	44	00	15.6	11.7	
	10.00 p. m.	38	22	00	72	54	00	15.0	11.7	
	11.00 p. m.	38	19	00	73	00	00	15.0	11.7	
	12.00 m.	38	15	00	73	09	00	15.0	12.2	
May 19	1.00 a. m.	38	11	00	73	18	00	15.6	12.2	
	2.00 a. m.	38	08	00	73	26	00	15.0	12.0	
	3.00 a. m.	38	04	00	73	26	00	15.0	12.0	

SURFACE TEMPERATURES TAKEN WHILE UNDER WAY DURING ATLANTIC CRUISES, SOUTH FROM NORFOLK, 1919, AND NORTH FROM NORFOLK, 1920—Continued.

Date.	Hour.	Latitude.	Longitude.	Temperature (°C.).		Stations between which taken.
				Air.	Surface.	
1920.		° ′ ″	° ′ ″			
May 19	4.00 a. m.	38 00 00	74 45 00	15.0	11.7	
	5.00 a. m.	37 56 00	74 53 00	15.0	11.7	
	6.00 a. m.	37 52 00	74 02 00	15.0	11.7	
	....	....	....	....	....	C20130.
	8.00 a. m.	37 48 00	74 11 00	16.1	12.2	
	9.00 a. m.	37 43 00	74 20 00	17.2	12.2	
	10.00 a. m.	37 37 00	74 29 00	17.8	12.2	
	11.00 a. m.	37 32 00	74 39 00	18.3	12.2	
	12.00 m.	37 27 00	74 48 00	17.8	12.2	
	1.00 p. m.	37 22 00	74 57 00	18.3	12.2	
	2.00 p. m.	37 16 00	75 06 00	18.3	12.2	
	3.00 p. m.	37 11 00	75 15 00	17.8	12.5	
	4.00 p. m.	37 06 00	75 25 00	18.3	13.3	
	5.00 p. m.	37 01 00	75 34 00	18.3	13.3	
	6.00 p. m.	37 04 00	75 42 00	18.3	13.9	
	7.00 p. m.	37 01 00	75 52 00	18.3	13.3	
....	....	....	....	....	....	[Cape Charles.]

PRESERVATION OF FISH NETS

By HARDEN F. TAYLOR

Assistant for Developing Fisheries and for Saving and Use of Fishery Products
U. S. Bureau of Fisheries

Appendix IV to the Report of the U. S. Commissioner of Fisheries for 1920

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PRESERVATION OF FISH NETS.

By Harden F. Taylor, *Assistant for Developing Fisheries and for Saving and Use of Fishery Products, U. S. Bureau of Fisheries.*

Contribution from the Fishery Products Laboratory, Washington, D. C.

INTRODUCTION.

The art of net preservation grew up long ago, as it might be expected inevitably to do, where it was necessary to make fishing gear of nonliving plant fibers that are exposed to the destructive effects of water, air, and sunlight. The word "art" of net preservation as distinguished from "science" of net preservation is used advisedly; one needs to see only the multiplicity of recipes for curing or preserving nets to be convinced that the processes belong to the same class as cookery or home treatment of diseases, where each locality and often each family has its own recipes or formulas, which are tenaciously adhered to and believed in. The many recipes found in the literature represent the fisherman's efforts to make his expense and labor count for more by prolonging the life of the net and reducing his overhead expenses.

The purpose of this paper is not to collect all these old recipes for preserving nets, but rather to review the literature of the subject and to present the fundamental principles in the light of chemistry so far as they are known, and to give for use those recipes which, from a chemical standpoint, seem best calculated to serve their purpose. It will be seen that while many methods as practiced are empirical and crude, they nevertheless contain the germ of correct chemistry, and not a little progress has been made in improvement of technique by chemists, notably Thv. Lindeman and Henrik Bull in Norway and J. T. Cunningham in England. Most of the work has been done by the Norwegians; as a matter of fact, only one important paper, that of Cunningham, has been found, in any language other than Norwegian, as shown by the list of references at the end of this paper.

NATURE OF DISINTEGRATION OF NETS.

MECHANICAL WEAR AND TEAR.

Before considering the various treatments that are given nets to prolong their usefulness, it may be profitable to consider the nature of the wear and tear that ruins nets. Obviously mechanical wear is one of the great enemies of nets. The threads rub against one another, against the gunwales of the boat, and against the floats and leads; this rubbing slowly abrades the threads and wears them out. Actual breakage by being caught on snags or by the struggles of large fish and the like must be reckoned with; such breakings, of course, become more numerous when the net becomes weaker by rotting. A factor in the destruction of nets that is sometimes overlooked may also be mentioned here: That when the threads are coated with thick tars and the like the total weight of the net is greatly increased and the preservative action of the tar is thus in part neutralized, the pull of the extra weight being added to other strains that may break the threads.

BACTERIAL DECOMPOSITION.

But of more importance than mechanical wear and tear in shortening the life of nets is the action—chemical in nature—of water and air, aided by other agencies, particularly bacteria, in causing a weakening and rotting of the fibers. This rotting deserves very careful study, for it destroys nets long before they would otherwise be destroyed by mechanical wear and tear, and its nature, while exceedingly complex, must be understood, at least in part, before remedial measures can be taken intelligently.

Up to this point chemistry has made some progress, and some valuable work has been done on the chemistry of preserving materials, but as a whole the fishing industry has never taken very kindly to chemistry, and most of the work that bears useful fruit for the net preserver has been incidental to work in other important fields—the tanning of leather, bacteriology, and textile science. We must admit frankly that we know very little directly about the intimate nature of the rotting of nets.

In the discussion of bacterial decomposition let it be assumed that cotton nets are being considered, because it is chiefly nets of this material that need preserving. They consist of fine fibers of almost pure cellulose, a substance very close to starch in composition, differing from it chiefly in being insoluble in water under all ordinary conditions, while starch, by simple treatment, may be made to dissolve. Cellulose can be made soluble in different liquids by severe chemical treatments. As bacteria are also capable of dissolving or rotting the fibers some detailed consideration will be given to their mode of action.

Bacteria are plants, so very small that they can be seen only by the aid of a microscope; they are not provided with many parts, as are the large plants of our acquaintance, as they have no roots, leaves, bark, or flowers; they are simple little rods or spheres, movable, reproducing under favorable conditions with the greatest rapidity. They have no claws, mouth, jaws, teeth, or any other offensive weapons. How, then, do they do the great damages that they are accused of? In a most interesting and important way. We know that land plants take nourishment from the ground and air by imbibing it and that they have no mouths or offensive weapons. So do bacteria, by absorbing or soaking up the food on which they live. But anything to be absorbed must first be made liquid; solids can not be soaked up, and it happens that very few natural foods are liquid. So the bacterium must secrete a digestive juice that causes the solid food surrounding it to liquefy, whereupon the liquid food is absorbed. This digestive juice acts in a way similar to that of the human digestive juice, and for the same purpose; the principal difference between our own digestion and that of bacteria is that ours takes place inside our bodies after the food is taken in, while the bacteria digest it before. So after all there is nothing incredible about it. Most bacteria are equipped for using a particular class of foods—they are meat eaters, sugar eaters, starch eaters, fat eaters—and they do not mix foods. They are able to secrete a digestive juice capable of liquefying that particular food on which they live.

Now, from what has been said, it is easy to see that the damage done to nets by bacteria must be done in either one of two ways, viz, the digestive juice itself or some of the changed products of digestion must attack the nets or else the waste products thrown off from the bacteria themselves (and some of these are active or virulent chemicals) must do so. If the digestive juices attack the cellulose fibers of the net, of course the fibers are dissolved, and this dissolution would be a very effective rotting. At any rate, what has already been said constitutes about all that can confidently be said about the intimate nature of bacterial decomposition of nets. If any more is to be known about it, a study must be undertaken.

For preserving nets against bacteria a number of possibilities suggest themselves. Since bacteria require water for activity, it is plain that if we keep the nets dry as much as possible we lessen the decomposition. But since the use of fish nets requires them to be wet, another step may be taken against the bacteria. It is possible to impregnate the fibers with substances that are poisonous to bacteria, or, quite as effective, which spoil the activity of the digestive juices produced by bacteria. Creosote and substances containing copper have been used for this purpose. Another method of preventing the destructive action of bacteria is to make the fibers insoluble and proof against the digestive action of bacteria. For hardening the fibers and making them harmful and indigestible to bacteria, tanning barks and extracts, such as birch bark, catechu, quebracho, quercitron, etc., have been used. These will be considered in detail later. Meanwhile other methods of resisting the action of bacteria are to cover the fibers with a protective coating, such as tar, linseed oil, etc.

OXIDATION.

Another enemy to nets is oxidation. The air consists of one-fifth oxygen, a colorless gas, which supports all fire and also is the active constituent of our breath. When one "sets fire to" a combustible material one so heats a small part of the material that the oxygen of the air combines directly with it. This combining releases more heat, which in turn hastens the combining of more oxygen with still more of the material, and so on, until the material is burning. While most combustible substances either burn rapidly or not at all, some things may oxidize slowly. For example, when nets are stored wet, covered with herring oil, blood, and slime, all of which are easily oxidizable, the oxygen of the air combines with these fish residues and probably also with the net. A heating thus begins, and the nets may even take fire; if not, the heat generated may be sufficient to weaken or destroy them.

To prevent this oxidation it may be sufficient to coat the nets with a covering like tar or linseed oil; it is, however, probable that tanning the fibers makes the fibers less likely to heat. The simple precaution of washing the nets clean and drying them while spread out is usually sufficient to prevent damage from overheating.

It is further possible that the products formed by the decomposition of fish slime and oil are injurious to nets.

Scarcely any treatment will confine itself to preventing any one of the attacks on nets mentioned above, but should be directed toward prevention of all causes of disintegration. The successful process must (*a*) destroy bacteria or prevent their action, (*b*) make the threads insoluble and proof against the digestive action of bacteria, and (*c*) prevent oxidation by coating the fibers or making them proof against oxidation.

COLORING OF NETS.

Before consideration is given to net-preserving materials, another purpose of curing nets should be mentioned. When nets are treated or cured, their color is usually changed, and it is argued that a less conspicuous net is less likely to frighten away fish. This is a disputed point (see Jessen, 1910),[a] though it might seem perfectly natural that an invisible or poorly visible net would be less likely to frighten fish. It must be remembered, however, that a fish does not see through human eyes but through fish eyes and that a color that is conspicuous to our eyes might not be readily discerned by a fish. The French sardine fishermen use (at least they did several years ago) a combination of soap and bluestone that imparted a bright green color to the nets; it was claimed that these caught more fish than nets not dyed. The Norwegians have a word, "*fiskelig*," that they apply to nets that are good catchers of fish. Bluestone is applied to nets (by methods to be mentioned later) to make them *fiskelig* by making them bluish green. This is done, of course, on the assumption that if the net is in color similar to sea water the fish can not see it well and so do not avoid it.

Many scientific investigations have been conducted to determine whether fishes can distinguish colors or not. Most of the evidence goes to show that they can; but perhaps they can see fewer colors than humans can. Some investigators have secured evidence that fishes do not distinguish color but that they get different amounts of light from different colors. Thus, a bright green would give more light, or appear lighter in shade, than a dark red, though a fish could get no effect of greenness or of redness. It is also possible, even probable, that different kinds of fish have different abilities to see colors. Thus, it is argued, light does not penetrate very deep into water, and so fishes living at some depth could not see colored objects, even if they had eyes equipped for color vision; and, since nature does not commonly provide useless organs or powers, color vision is not among the accomplishments of bottom-living fishes.

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[a] Author's name, with year mentioned in parenthesis, refers to the "Citation of Literature" at the end of this paper. For example: Jessen (1910) refers to the paper by Peter Jessen,, published in 1910, a reference to which will be found at the end of this paper.

But it is not necessary to go further into this disputed subject. It stands to reason that fish perceive differences of brightness, and probably of color, and that if we make a net similar to sea water in both shade and color it will not be so readily visible. Those who might wish to go into this subject are referred to the article by Reeves (1919).

PRESERVATION OF NETS BY TANNING MATERIALS.

The materials most widely used for curing nets are tanning materials—barks of birch, oak, spruce, hemlock; extracts of bark or wood, such as catechu, quercitron, quebracho, and the like. For preserving, the original process consisted of immersing or soaking the net in a decoction of bark, or in a solution of the extract. One of the earliest methods was the so-called "cold-tanning," a slow process described by Aase (1912). This writer says that the old Norse fishermen used the same nets over and over for from 30 to 50 years. He also says that while much of this superiority of their nets might be explained by the fact that their thread was selected and spun by hand, and therefore better than modern machine-spun threads, the difference between those times and the present, when one is lucky to use a net for from 3 to 10 years, is too great to be explained by the homespun theory. He accounts for the difference by the cold-tanning process, described as follows:

COLD TANNING.

> Every net owner had his own large tanning vessel, which provided a place for both bark and net. In this vat was placed as much water as there was use for, and to every barrel of water was added 1½ vog (1 vog=36 pounds) of birch bark, well broken up. This was allowed to stand four or five weeks, but was daily stirred around with a stick so that it could not become thick and slimy. The nets were put into this mixture. In the bottom of the vat a hole was provided so that the finished liquor could be tapped into a tub and poured back over the net to cover thoroughly the upper part of the net which otherwise might not come under the bark. The net remained in this vat two or three days, and every day the liquor was poured over it several times.
>
> Such a barking gives little color, but makes the net hard. To produce the desired color it must not go into the bark a single time only. Nay, it must be dried and again laid in the tan vessel if there is any bark left, as many as four or five times. After it is dried it is dipped into the sea, and it now takes on its right color for the first time—a color it will hold for years. If the barking is repeated every year the net becomes harder and harder as it grows older.
>
> The method takes a long time, and demands much labor; when more and greater nets began to be used, and prices of birch bark also rose, other methods of barking began to be tried.

HOT TANNING.

The next step in the development of processes of net curing was the employment of a warm barking. The bark is boiled, and the nets are treated in the hot decoction. Aase is authority for the statement that "with this method of tanning the net acquires color and hardness with one treatment, and much time can by this method be saved. But experience has shown that warm tanning does not endure, by a great deal, so long as cold tanning."

Then the extract, catechu, came into use. This extract is not so bulky, is readily soluble in water, and has been used successfully. The methods as practiced varied greatly, the variations being apparently not based on any particular reason. In general, the extract is dissolved in water—1 pound of catechu to from 1 to 3 gallons of hot water—and applied to the nets.

Nets preserved with tanning extracts are brown or tan in color and are more resistant to decay than untreated nets, as will be seen in figures to be given later. The tan, however, washes out, and it is necessary to repeat the treatment often.

CHEMISTRY OF TANNING MATERIALS.

Before going further with the methods of curing nets with tanning materials, it will be necessary to consider the chemistry of the latter.

It is not improbable that the treatment of nets by tanning was induced by the success of the treatment of animal skins by such materials to make leather. Tanning materials are bark or other parts of various trees which produce a reddish or brownish solution when steeped in cold water. There is scarcely a tree or shrub in some part of which tanning substances are not found.

The action of those materials may be illustrated by their effect on leather. Untanned hide when boiled for some time is nearly all dissolved; after it has been treated with tan liquor it is scarcely affected by boiling. When untanned hide is left in a moist condition for some time it putrefies; tanned hide does not. Thus a hide that is soluble in boiling water and putrefies in cold water is converted by tanning into a hide which is neither dissolved in hot water nor putrescible in cold. Just how these great differences are brought about can be illustrated by the effect of tanning materials on gelatin or glue. If a tanning extract be added to a solution of gelatin, the latter is coagulated and precipitated and is made permanently insoluble. Pure untreated gelatin readily swells in cold and dissolves in warm water and easily decomposes if left wet. But this tanned precipitate is resistant to the action of water and does not decompose. How is this important change brought about? The answer is given by a pair of balances. If we weigh a dry piece of gelatin, dissolve it, precipitate or curdle it with tan liquor, collect the precipitate or curd, wash, dry, and weigh it, we find that it has increased in weight. It can also be shown that the tan liquor has lost as much weight as the gelatin has gained—something from the tan liquor combined permanently with the gelatin to make the latter insoluble and resistant to change. This something is called tannin. It would be more correct to say these somethings, for there are several tannins, all closely akin, all affecting gelatin in the same way. It is they that, acting on hides, convert the soluble, putrescible gelatins in hides into insoluble substance, causing the hides to become leather.

The earlier method of analyzing tanning materials was to treat the solution with gelatin. This was done by taking first a definite volume of the solution and evaporating it to dryness and weighing the dry residue; then a like volume was taken from a sample that had been treated with gelatin, evaporated to dryness, and weighed. The sample that had been treated with gelatin had lost weight. The loss represents, of course, the substance taken up by the gelatin or tannin.

Since to the leather tanner the chief item of interest is the amount of substance actually taken up by hides, gelatin, as a measure of the tanning power of materials, has been supplanted by hide powder, which is clean oxhide dried and ground in a suitable mill. The liquor is drawn through this, and the difference in the weight of dried residue is noted and recorded as tannin. Account is also taken of the difference between weights of the liquor and dried residue, this difference representing water. There is also given the percentage of matter that does not dissolve in cold water, but which was filtered off of the liquor. Thus an analysis of a tanning material intended to represent its value for leather tanning gives four figures, of which the following is a typical example (Cunningham, 1902) of Burmah cutch or catechu:

	Per cent.
Tannins	46. 6
Nontannins	20. 0
Insoluble	11. 5
Water	21. 9
Total	100. 0

There are some very significant differences between the treatment given to hides in making leather and that given to nets to preserve them and in the behavior of the treated materials. Hides, once they have taken up tannins, never let go, even though they are boiled or soaked in water; nets, however, lose their tanning materials rapidly in water, so that they must be tanned repeatedly if the method used for treating them is the same as that used for treating leather. It is thus obvious that the tannin does not combine in nets with any gelatin or other similar substance, but rather is merely deposited in the fibers. There is another important difference: Hides are tanned in a cold decoction of tan bark or extract, while nets are usually treated in hot liquors.

When catechu, for example, is dissolved in cold water, there always remains a residue, which appears in the analysis given above, as "insoluble." If the solution is heated to boiling, nearly all of this apparently insoluble material dissolves, only some pieces of leaves, sticks, and sand remaining. If the liquor is cooled off, the insoluble material again separates from solution. There is thus a comparatively large amount of substance insoluble in cold water but soluble in hot water. Upon examination, this substance, catechin, is found to be an active tanning material, and for the purpose of net preserving is better than that which is soluble in cold water, because it will not dissolve out in use. Cunningham tried to fix the tannin in nets by first impregnating them with glue (which is crude gelatin) and then treating them with catechu. The effort resulted in failure, apparently because the glue did not penetrate the fibers.

The coloring matters in barks and extracts are independent of the tannins and have no tanning power. Pure tannin (gallotannic acid from nut galls) is a light grayish yellow flaky powder, easily soluble in water.

Since the value of tanning material for net preservation depends upon the abundance of tannins, analyses should support important purchases. The following are analyses made of different samples of catechu, or cutch, by Cunningham, using the hide-powder method:

	Burmah.	Tuan.	Mudah.	Caller Herrin.
Tannins......per cent..	46.6	46.0	45.2	50.8
Nontannins......do....	20.0	9.8	15.6	14.9
Insoluble......do....	11.5	17.1	4.8	2.2
Water......do....	21.9	27.1	34.4	32.1
Total......do....	100.0	100.0	100.0	100.0
Strength after exposure......pounds; ounces..	5;6	8;0	2;4	2;9
Strength after exposure......kilograms..	2.437	3.629	.964	1.161

It is seen from the above table that there is a considerable difference between the values of the various samples of catechu, a fact equally true of other tanning extracts. The last two figures under each sample (which the writer has given also in kilograms for convenience in comparing with the Norwegian figures that are to follow later) represent breaking strength. Cunningham explains as follows how these figures were obtained:

> In order to test the actual preserving power of different samples of cutch, I adopted, in my investigations in Cornwall, the following method: I procured a machine for testing the strength of a net before and after the experiments. The principal part of such a machine, which is called a dynamometer, is of the nature of a spring balance. One mesh of the net is attached to the balance, the other at a certain distance to a hook or knob which can be pulled away gradually by turning a handle. As the strain increases the hand on the dial of the balance indicates in pounds and ounces the weight which is equal to the strain until one of the meshes breaks, when the hand shows the number of pounds equal to the breaking strain.
>
> In comparing the value of the different materials or processes of curing, I took pieces cut from the same net, and, therefore, when new, of the same strength, cured them, then fastened them by mooring at the bottom of Newlyn Harbor. After they had been under water a certain time the pieces were taken up and tested on the dynamometer and found to be of very different strengths, which showed the differences in the preserving properties of the various materials or processes.
>
> One of the earliest experiments carried out on this method proves the preserving power of that part of cutch which is insoluble in cold water. So far as I know, there is no natural cutch or tanning extract which is completely soluble in cold water for the very good reason that the cutch or extract is generally made by boiling. But some of the red cutches put upon the market by the Borneo companies are almost entirely soluble in the cold, either because they have been chemically treated or because the insoluble part has been removed from them.
>
> In this experiment I tested four kinds of cutch [as above]. The last three were red or mangrove cutches from Borneo. In every case the strength of the solution used was 1 pound to 1 gallon of water, the net was dipped twice, being left half an hour in the liquor each time and dried between the two dips. The pieces of cured net were left under water, uncovered only at low water in spring tides, for five weeks, and then tested.

Further reference to the table above will show that the Caller-Herrin catechu which contained the highest percentage of tannin was one of the poorest in preserving power where the nets were actually exposed for a long time to water and tested for strength. The Tuan catechu was best, though it contained the greatest percentage of insoluble matter, which would ordinarily be considered objectionable. This fact shows that the insoluble matter may add greatly to the value of the catechu. The reason for this superiority has already been mentioned. The analysis is made by dissolving samples of material in cold water. That which does not dissolve in cold water is recorded as insoluble and is useless to the leather tanner. But a great part of this insoluble matter is readily soluble in hot water, and, inasmuch as the nets are treated in the hot solution, this matter is deposited in the fibers and stays in the nets while the cold-water-soluble tannins wash out when the nets are put to use.

It will thus appear that analysis of tanning extracts made for the leather tanner's purpose is not all that could be wished from the fisherman's point of view. Cunningham recommends that for the use of net preservers there be included in the usual analysis a figure representing the amount of tannins insoluble in cold but soluble in hot water.

It might prove to be profitable for chemical manufacturers to go a step further than this by separating commercial catechu into two parts, the cold-water-soluble part suitable for the leather industry, and the hot-water-soluble part, not suitable for leather tanning, but preferable for the preservation of fishing gear.

With the provision that the hot-water-soluble tannins be considered in making calculations, Henrik Bull's (1912) point may be regarded as important; that is, that when tanning extracts are bought by the pound without reference to their content of active tannins, very unprofitable purchases may be made. Thus, if a sample of catechu sells for $0.10 per pound, and contains 40 per cent tannins, the actual price we pay for tannin is 10/40, or $0.25 per pound. Further, as will be seen from the following table, the cheaper grades of catechu may (but do not necessarily) furnish tannin at a price considerably higher than would be paid for actual tannin in more expensive grades of extract.[a]

Sample.	Price per pound.	Percentage tannin present.	Price tannin per pound.
A	$0.09	35	$0.26
B	.10	45	.22
C	.11	55	.20
D	.12	65	.185

To calculate the actual cost of tannin where an analysis is available, use the formula:

$$\text{Cost of tannin per pound} = \frac{\text{cost of extract per pound}}{\text{percentage of tannin in extract}}$$

that is, divide the cost of extract per pound by the percentage of tannin in the extract, and the quotient represents the cost per pound of the tannin.

---

[a] The original table is in Norwegian øre per kilogram of extract. Since, however, the table is only intended to represent a comparison, the writer has assumed suitable figures for American readers.

TANNING MATERIALS USED FOR FISH NETS.

Up to this point attention has been given to catechu. There are numerous other tanning materials put upon the market as bark or wood or as extract. The extract may be liquid, solid, in lumps, or in a fine powder prepared by a recently developed process. The principal tanning materials, as given by Cunningham, are:

> Oak bark, the bark of the common English oak, is largely used for tanning leather. The barks of another species in Turkey, and of the chestnut oak (*Quercus castanea*) of America are also used. The bark is stripped from the trees when they are about 15 years old.
>
> Hemlock bark is really the bark of a kind of pine abundant in America, called Canadian pine (*Abies canadensis*). It is the principal tanning material of the United States. The extract of this material in liquid form has been recommended for net curing under the name of Canada cutch, and is sold in tins containing about 3 pounds weight.
>
> Mimosa, or wattle bark, is obtained from various Mimosæ or acacia trees growing in Australia, where this is the staple tanning material.
>
> Quebracho is obtained from several kinds of South American trees. It is imported largely in the form of both dry and liquid extracts.
>
> Valonia consists, not of the bark, but of the cups of the acorns of a certain oak (*Quercus œgylops*) growing in the Levant.
>
> Sumach consists of the leaves of a plant dried and ground. The plant grows in the south of Europe.
>
> Gambier, or terra japonica, is a dry extract prepared from the leaves and twigs of a tree called *Uncaria gambier* in the Malay Peninsula. It is imported from Singapore. There are two forms, block gambier, in large masses, and cube gambier, in small, light-yellow cubes. It is not much used for net curing, but I believe has been used in former times at some places, such as Clovelly, under the name of catechu.
>
> True cutch, or catechu, is a dry extract made from the wood of a tree called *Acacia catechu*, which grows in India and Burmah. It may be distinguished as Burmah cutch, as its manufacture is carried on chiefly by natives, according to their own traditional methods, in Burmah. It is imported from Rangoon. Until recently it was used everywhere around the British coasts for net curing, and was used in far larger quantities than any other tanning material.
>
> Red cutch or mangrove cutch is made from the bark of mangrove trees, which grow in swamps at the mouths of rivers in tropical countries. This cutch is now manufactured extensively by two British companies in Borneo, and is largely used for net curing, having replaced Burmah cutch to a considerable extent.
>
> Myrobalans, divi-divi, and algarobilla are raw materials consisting of the dried fruits or seed pods of different trees. They are imported for use in the leather industry, but are not used for net curing. Canaigre is also a raw material, consisting of the root of a plant growing in New Mexico and Arizona, not used for the fishing industry.

To this list should be added quercitron, a large timber oak (*Quercus velutina*) of the eastern United States, having foliage resembling that of the red oak, but with yellow inner bark. It is on the market as rough bark, rossed bark, ground bark, and solid and liquid extracts. As will be seen later, Bull found this to be one of the best materials for curing nets.

It is thus seen that there are a great many tanning materials, that in common they have tannin, and that this tannin in some way prevents rotting of nets, probably by destroying the digestives with which the bacteria seek to rot the net, or by making the thread indigestible. At any rate, actual measurements of strength show that tannins do preserve nets, and that the principal objections to them as ideal preservatives are that if used unaided they wash out of the nets, and that if the preservation is to last the application must be often repeated.

FIXING OR MORDANTING OF TANNED NETS.

The next step, therefore, is to cause the preserving tannin to stay in the net, and to do this it is necessary to know something of the chemistry of the tannins. It has already been shown that tannins combine with gelatin to form a permanently insoluble substance, this combination being the essential principle in converting hides into leather. Gelatin exists naturally in hides, but there is nothing naturally occurring in cotton corresponding to gelatin with which the tannin can form an insoluble compound.

Tannin is readily oxidized; that is to say, it readily takes up and combines with the oxygen of the air, and when so combined is insoluble and much darker in color. Why, then, does not the tannin oxidize and stay in nets? In fact it does, to a certain extent, as any fisherman who has used "barked" nets knows the nets never regain their original whiteness. But the oxidation takes time, and in practice the net is put into the water before much of the tannin is oxidized, whereupon the unoxidized tannin promptly washes out. To store the net for a time after barking would do little good, for in a dry condition the oxidation proceeds very slowly or not at all. Repeated wetting and drying was credited by Bull in his comments on the paper by Aase referred to above, with the eventual thorough impregnation of nets by the old-time, cold-barking method. It is probable that by holding the nets wet for a long time after barking and allowing free access of air the tan might be fixed permanently in the fibers.

There is, however, no need to do this, for once the chemistry of the process is understood the same end may be achieved by quicker chemical means. There are a number of chemicals which contain oxygen in large quantities, and which yield up this oxygen easily. One such chemical is potassium bichromate. If a solution of potassium bichromate be added to a solution of catechu, a dark-colored, insoluble compound is formed—the combination of tannin with oxygen, the oxygen coming from the potassium bichromate. Advantage is taken of this principle in dyeing; catechu or some other natural wood dye is applied to the fibers and then darkened and fixed by a solution of potassium bichromate. This process is used primarily in the leather and textile industries for the coloring it gives, but no modification is needed to use the method for preserving nets.

The bichromate acts not only on the tannins that are soluble in cold water, but upon the catechin that is soluble in hot water.

The oxidation of tannins is greatly accelerated by alkalis—lye, soda, potash, etc.—but these all have a very objectionable characteristic in that they cause to dissolve in cold water the tanning substance which in its natural state is soluble only in hot water. These alkalis are therefore not used.

CUNNINGHAM'S EXPERIMENTS.

The very thorough work done by Bull in Norway and Cunningham in England has made it possible to preserve nets at much less labor and expense by use of potassium bichromate. To quote Cunningham:

> Accordingly I made at Newlyn a large number of experiments * * * to test whether by the use of bichromate the net could be preserved more successfully or more cheaply, and the results were very favorable. One of the most striking of these experiments was made entirely with Burmah cutch, of the Double Eagle brand. The pieces of net used were cut from the net made at Bridport, 25 rows to the yard, 12-ply cotton. The strength of the net when tested new and uncured, or "white," was 15½ pounds * * *. Four pieces of net, cured with and without bichromate, as shown below, were put down in Newlyn Harbor on January 31, 1900, and taken up and tested on March 3, so that they were in the water between four and five weeks. The strengths given are the averages of five trials on the testing machine:
>
> | | Pounds. | Ounces. |
> |---|---|---|
> | 1. Dipped once in Burmah cutch, 1 pound to 1 gallon of water | 4 | 2 |
> | 2. Dipped *twice* in Burmah cutch of same strength, dried after first dip | 6 | 5 |
> | 3. Dipped once in Burmah cutch, same strength, with 1 ounce bichromate potash added to 1 gallon cutch liquor | 5 | 3 |
> | 4. Dipped once in Burmah cutch, same strength, then dipped separately in hot solution of bichromate, one-half pound to 1 gallon water | 14 | 5 |
>
> It will be seen that of these four pieces of net, which were placed in the harbor at the same time, fastened to the same piece of rope, three were practically rotten, while the fourth was nearly as strong as when new, and this fourth piece was the one that had been cured with bichromate of potash.

Dipping twice in cutch alone (No. 2) seems to improve the net very little. Experiment No. 3 shows that the bichromate does no good if added to the cutch solution, but must be applied *separately* to be effective. The reason for this, as will be seen above, is that the bichromate makes the tannins insoluble, so that they do not get into the fibers at all.

The bichromate solution used above was strong.

The following series of tests shows the results with weaker bichromate solution, and different combinations, nets submerged January 31, taken up March 30, put down again May 14, finally taken up and tested May 28:

	Pounds.	Ounces.
1. Burmah cutch, 1 pound to gallon, net put in hot liquid and left to soak 24 hours	4	14
2. Mangrove cutch A, a somewhat insoluble kind; same treatment	5	12
3. Mangrove cutch B, another brand; same treatment	7	6
4. Burmah cutch, same treatment; net then dipped in hot bichromate, 1 ounce to 1 gallon water	13	5
5. Mangrove cutch A, same treatment, following by hot bichromate, same strength	14	9
6. Mangrove cutch B, same treatment, followed by hot bichromate, same strength	13	5
7. Mangrove cutch B, 1 pound, with 1 ounce bichromate, boiled together in 1 gallon water, net left to soak 24 hours	1	13
8. Burmah cutch, 1 pound, with 1 ounce washing soda, boiled together in 1 gallon water, net left to soak 24 hours	6	12
9. Mangrove cutch A and soda; same treatment	4	2
10. Burmah cutch, 1 pound to 1 gallon sea water instead of fresh	5	13
11. Mangrove cutch A, in sea water; same strength	6	5

Here, again, it is shown that no treatment appears to do much good without the after treatment with bichromate. The use of bichromate *with* the cutch destroys any preserving power the cutch alone may have. The small differences between the different varieties of cutch and the different modes of handling, exclusive of the bichromate after treatment, are not significant.

The following is another series of experiments made by Cunningham in which quebracho and cube gambier were tried:

The pieces in this case were left in the harbor from May 28 to July 15, a period of seven weeks. The pieces of net were cut from another new net, which seems to have been of better quality than that previously used, as the pieces cured with cutch alone were not so weak after exposure as in previous experiments:

	Pounds.	Ounces.
1. Mangrove B, alone, 1 pound to 1 gallon water, dipped once, soaked 10 minutes	12	5
2. Quebracho alone, same strength, same treatment	9	5
3. Cube gambier alone, same strength, same treatment	5	
4. Mangrove B, as before, then dipped in hot bichromate, 1 ounce to 1 gallon water	13	8
5. Quebracho as before, followed by bichromate, 1 ounce to 1 gallon	12	8 14
6. Gambier as before, followed by bicromate, 1 ounce to 1 gallon	11	5
7. Mangrove B, 1 pound, soda 1 ounce to 1 gallon water, net dipped in mixture then dipped in bichromate, 1 ounce to 1 gallon water	7	8
8. Gambier with soda, then bichromate in above proportions	7	12
9. Mangrove B, one-half pound to one-half gallon water, mixed with one-half pint bichromate solution, 1 ounce to 1 gallon	7	8
10. Quebracho mixed with bichromate, same proportions	10	10
11. Quebracho, one-half pound, bichromate one-half ounce to 1 gallon water, together	5	10

Again, it is shown that bichromate, if used as a separate after-treatment, greatly increases the preserving effect of the tanning materials; it also further confirms the conclusion that bichromate mixed with the tanning material does harm rather than good. Soda added to the tanning extract previous to use is rather harmful than otherwise, as shown by trials Nos. 7 and 8.

LINDEMAN'S EXPERIMENTS.

Thv. Lindeman (1897), in the prize-winning paper submitted in competition before the Trondhjem Fishery Society in 1896 for the best paper on preservation of nets, seems to have been first to use the dynamometer, or breaking-test, method of studying the preservation of nets. On two kinds of thread, hemp and cotton, he tried 12 preserving materials in comparison with untreated thread, as follows:

I. Thread, without treatment.

II. Bluestone.—1½ kilos (3.3 pounds) bluestone, 1 barrel water. Net lies in this 1 day, washed out without drying, and then put directly into the sea.

III. Catechu with mordant.—To 7½ kilos (16.2 pounds) net, take 1 to 1¼ kilos (2.2 to 2.75 pounds) catechu, which is boiled until dissolved; add 60 grams (2 ounces) bluestone. The net is put in this bath while it is warm (60° C. or 140° F.) and allowed to stand over night. The next day it is well drained and brought into a bath (80° C. or 176° F.) in which is dissolved 180 grams (6.4 ounces) potassium bichromate.

IV. Catechu with linseed oil.—The net is prepared according to III, dried by artificial drying, and brought into warmed raw linseed oil, in which it lies until next day; it is then taken out, freed as much as possible from the oil, and dried in air.

V. Birch bark, cold.—20 kilos (44 pounds) birch bark is added to 1 barrel water; to this is added 1 to 2 kilos (2.2 to 4.4 pounds) of soda. This stands cold about 8 days to extract. The net lies in this 1 to 2 days.

VI. Linseed oil, raw.—The net is first artificially warmed; it is then laid in raw linseed oil for 1 day. It is then taken out, freed of oil, and dried as in IV.

VII. Spruce cones.—To one-half barrel of water a quarter of cones is taken. This is boiled vigorously about 3 hours. After it is cooled off the net lies in it about 2 days.

VIII. Wood tar, Norwegian.—The net is artificially dried as in VI, laid under warm wood tar for a sufficient time to assure that it is thoroughly penetrated, after which it is taken out and freed of excess.

IX. Quebracho wood.—10 kilos (22 pounds) to about 150 liters (40 gallons) water, boiled for 1 hour, after which the net is laid in it while it is still warm and allowed to lie in it a couple of days.

X. Zinc chloride.—1 kilo (2.2 pounds) zinc chloride to 100 liters (30 gallons) water; net is allowed to lie in this 1 day.

Before treatment a series of trials was made on different places in the skein of thread used. The results of these stretching tests were as follows:

	A. Hemp.	B. Cotton.
Average breaking load	14.9 kilos (av. of 13 tests).	8.5 kilos (av. of 10 tests).
Weight per meter	0.623 gram.	0.494 gram.
Breaking length	23.9 kilometers.	17.1 kilometers.

It will be observed that in addition to the breaking load, Lindeman also gives the weight per meter of the thread and "breaking length." This latter figure denotes the length of thread that will hold itself up, or the length of thread in a ball whose weight is the breaking load. The strength of thread as ordinarily understood means strength for a given size or weight, for of course a thread can be made of any strength if it is only large enough. The smaller and lighter a thread of given strength, the better. This figure, breaking length, probably furnishes a better basis, if proper precautions are taken, than breaking load, of the quality of a net. Since the weight of a meter of thread is given and the breaking load is given, the breaking load divided by the weight of a meter will give the breaking length in meters (1 kilometer=1,000 meters, or 0.6 mile).

This breaking-length figure is particularly valuable in judging such preservatives as tar and linseed oil, preservatives that add considerable weight to the net. This figure may go to show that where a net must support its own weight, one that appears to be well preserved may be, in fact, poorly preserved because of the greatly increased weight.

After testing the original thread, Lindeman treated different samples by the methods described above, and put them, along with untreated samples, in the sea, and after varying lengths of time measured strength and weight.

The nets were put in the sea October 6 (1895).

First test, 8 days afterward.

Second test, February 1 (1896), after about 14 weeks.

Third test, May 3, about 13 weeks after second test. After the third test the samples were destroyed by a passing boat. A new series was prepared and hung out in the sea July 7.

Fourth test, October 1 (1897), after 12½ weeks.

Fifth test, January 1 (1897), after 13 weeks.

The test pieces taken up October 1 were covered with mussel spat, and were greatly reduced in strength. By the time the fifth test was made the nets had so far disintegrated that they could not be tested on the dynamometer; the investigator therefore made notes with the letters, *a*, *b*, and *c* to indicate how far gone they were, meaning something like poor, poorer, poorest.

It is apparent that the pieces of net used for the fourth and fifth tests underwent decomposition much more rapidly than the earlier ones. While Lindeman offers no explanation of this difference, it may be readily explained by the warm weather, since it is common experience that nets rot more rapidly in warm weather than in cold.

The results of these tests are summarized in the accompanying table. Each figure represents an average of from 5 to 13 trials, so that differences in particular places on the thread are ironed out to some extent.

Strength and weight of thread.	I. Without preparation.	II. Bluestone.	III. Catechu with mordant.	IV. Catechu with linseed oil.	V. Birch bark.
A. HEMP.					
Test 1:					
Breaking load..........kilogram..	13.3	12.6	13.7	10.9	11.5
Weight per meter..........gram..	.600	.675	.696	.910	.628
Breaking length..........kilometer..	22.2	18.7	19.7	12.0	18.3
Test 2:					
Breaking load..........kilogram..	8.6	11.2	12.2	14.0	9.1
Weight per meter..........gram..	.554	.593	.723	1.000	.660
Breaking length..........kilometer..	15.7	18.9	16.8	14.0	13.8
Test 3:					
Breaking load..........kilogram..	6.4	11.8	12.1	13.2	9.7
Weight per meter..........gram..	.509	.646	.687	.837	.652
Breaking length..........kilometer..	12.5	18.3	17.6	15.8	14.9
Test 4:					
Breaking load..........kilogram..	...	9.0	7.7	7.9	4.6
Weight per meter..........gram..	...	.804	.688	1.200	.732
Breaking length..........kilometer..	....	11.2	11.2	6.6	6.3
Test 5:					
Breaking load..........kilogram..	...	...	9.1	7.5	...
Weight per meter..........gram..	...	(*b*)	.765	1.045	(*c*)
Breaking length..........kilometer..	....	....	11.9	7.1	....
B. COTTON.					
Test 1:					
Breaking load..........kilogram..	7.8	8.2	7.9	5.6	7.8
Weight per meter..........gram..	.558	.507	.566	.961	.538
Breaking length..........kilometer..	13.9	16.1	13.9	5.8	14.5
Test 2:					
Breaking load..........kilogram..	3.7	7.7	8.5	7.5	6.1
Weight per meter..........gram..	.497	.493	.610	.894	.530
Breaking length..........kilometer..	7.6	15.6	13.9	8.4	11.5
Test 3:					
Breaking load..........kilogram..	2.3	7.0	9.3	7.4	3.8
Weight per meter..........gram..	.530	.564	.610	.865	.577
Breaking length..........kilometer..	4.4	12.8	15.2	8.5	6.6
Test 4:					
Breaking load..........kilogram..	...	2.7	6.7	7.1	2.8
Weight per meter..........gram..	...	.489	.580	.822	.536
Breaking length..........kilometer..	....	5.5	11.5	8.6	5.2
Test 5:					
Breaking load..........kilogram..	...	...	5.8	6.3	...
Weight per meter..........gram..	...	(*c*)	.570	.764	(*c*)
Breaking length..........kilometer..	....	....	10.2	8.2	....

NOTE.—*a*, *b*, and *c*, meaning something like poor, poorer, poorest, indicate that nets had disintegrated too far to be tested on the dynamometer.

Strength and weight of thread.	VI. Linseed oil.	VII. Spruce cones.	VIII. Tar.	IX. Quebracho.	X. Zinc chloride.
A. HEMP.					
Test 1:					
Breaking load ... kilogram..	12.6	13.4	10.8	12.5	11.4
Weight per meter ... gram..	.821	.852	.987	.720	.679
Breaking length ... kilometer..	15.3	15.7	10.9	17.4	16.8
Test 2:					
Breaking load ... kilogram..	11.5	12.4	13.1	11.9	8.1
Weight per meter ... gram..	.704	.678	.958	.686	.588
Breaking length ... kilometer..	16.3	18.3	13.7	17.3	13.8
Test 3:					
Breaking load ... kilogram..	12.9	12.6	11.9	12.7	6.6
Weight per meter ... gram..	.642	.712	.792	.803	.622
Breaking length ... kilometer..	20.1	17.8	15.0	15.8	10.6
Test 4:					
Breaking load ... kilogram..	7.8	3.5	9.3	5.0	...
Weight per meter ... gram..	.840	.700	1.030	.738	...
Breaking length ... kilometer..	9.3	5.0	9.0	6.8	....
Test 5:					
Breaking load ... kilogram..	...	...	...	...	...
Weight per meter ... gram..	(c)	(b)	(a)	(b)	...
Breaking length ... kilometer..	....	....	....	....	...
B. COTTON.					
Test 1:					
Breaking load ... kilogram..	7.0	8.5	7.8	8.1	7.2
Weight per meter ... gram..	.727	.585	.974	.559	.647
Breaking length ... kilometer..	9.6	14.5	8.0	14.5	14.0
Test 2:					
Breaking load ... kilogram..	8.4	8.6	7.6	8.2	3.0
Weight per meter ... gram..	.734	.571	.848	.564	.487
Breaking length ... kilometer..	11.4	15.1	8.8	14.6	6.2
Test 3:					
Breaking load ... kilogram..	8.5	8.5	8.4	8.1	2.9
Weight per meter ... gram..	.710	.600	.830	.590	.523
Breaking length ... kilometer..	12.0	14.1	10.1	13.7	5.5
Test 4:					
Breaking load ... kilogram..	6.0	3.7	6.8	2.9	...
Weight per meter ... gram..	.660	.510	.856	.495	...
Breaking length ... kilometer..	9.1	7.3	7.9	5.9	...
Test 5:					
Breaking load ... kilogram..	...	...	...	...	...
Weight per meter ... gram..	(c)	(b)	(a)	(b)	...
Breaking length ... kilometer..	....	....	....	....	....

Of the methods that depend on tannins for their activity, Nos. III, IV, V, VII, and IX, only two may be considered at all successful; they are Nos. III and IV. These two received identical treatment—i. e., catechu with copper sulphate and potassium bichromate—but No. IV received a subsequent treatment with linseed oil. If judged by the breaking strength alone, the linseed oil adds a very little; but if judged by breaking length, it is not so good as the previous one.

Of methods of tanning nets this is additional evidence that the use of a fixer or mordant, potassium bichromate, greatly increases the preserving quality of tanning materials.

The use of zinc chloride suggested itself to Lindeman because it converts cellulose into so-called hydrocellulose and is used as a preservative for railroad crossties. It is a failure for preserving nets.

The nontannin preserving materials will be considered later.

Another point about the table worthy of notice is that tannins have an effect on hemp nets similar to that on cotton, but not so great.

It should also be noted that Lindeman's paper appeared five years earlier than Cunningham's paper, or that of Bull, next to be considered.

BULL'S EXPERIMENTS.

Bull (1901), in Norway, carried on a similar series of experiments, using a greater number of combinations, including oak bark, quercitron extract, and coal tar. He also carried out more elaborate processes of preparation, including such manipulations as three or four baths and combinations of second treatments. The table following gives Bull's results and carries brief descriptions of the methods used. In the text Bull says he barked the nets in "the customary way."

Lindeman used the bluestone (or copper sulphate, copper vitriol, blue vitriol, as it is variously called) in the same bath with the tanning material. On this point Bull (1901) says:

> When I began this investigation, since I used quercitron extract in as pure a condition as was obtainable, in lieu of catechu, I observed that in solution in water it has, with copper-vitriol solution, a reaction that produces a precipitate which dissolves with difficulty in water, for which reason the coloring method must be regarded as disadvantageous, because the precipitate is formed rather on the thread and is not in the solution. In addition, I found that the second bath may be also harmful in the use of very warm (80° C. or 176° F.) solution of potassium bichromate, since this strong agent, with the high temperature used, may very well cause a weakening of the thread.

Bull also says:

> As a barking material quercitron extract has shown itself to be the best. * * * A noteworthy result is shown in experiment 17, in which the net is barked twice with quercitron extract and afterwards treated with the oxidation mixture. It is shown that the net, after 11 weeks, is of the same strength as before it was immersed in the sea, namely, 23 kilograms.

Quercitron, as well as other tanning extracts and barks, can be secured from American dealers in tanners' supplies.

The copper may have some preserving action; Cunningham thinks it is injurious. It appears to the writer that, while it may strengthen the defense against certain organisms, its chief use on nets is to impart a dark, durable color.

Experiment No.	Method of preparing the thread. After treatment, No.— I.	II.	III.	IV.	Breaking load, after— Preparing.	Sunlight 14 days.	Stored moist 14 days.	Moistened with herring offal 14 days.	1 week in sea water.	5 weeks in sea water.	7 weeks in sea water.	9 weeks in sea water.	11 weeks in sea water.	Weight of 10 meters.	Thread takes up water.	Breaking length.[a]
					Kilograms.	*Kilograms.*	*Kilograms.*	*Kilograms.*	*Kilograms.*	*Kilograms.*	*Kilograms.*	*Kilograms.*	*Kilograms.*	*Grams.*	*Per cent.*	*Kilometers.*
0	Untreated				1.95	1.75	1.85	1.65	1.98	0.0	0.0	0.0	0.0	1.45	227	13.5
1	Catechu				2.13	1.90	2.02	2.09	1.88	.48	.12	.0	.0	1.514	282	14.1
2	do	Bluestone and potassium bichromate.			2.00	1.77	1.84	1.88	2.00	1.88	1.7	1.87	1.58	1.656	254	12.0
3	Spruce bark				2.02	1.95	2.00	1.35	2.04	.20	.0	.0	.0	1.576	250	12.8
4	do	Bluestone and potassium bichromate.			2.00	2.07	1.84	2.00	2.09	1.82	1.97	1.79	1.42	1.514	232	13.1
5	Birch bark				2.03	2.15	2.59	2.24	2.19	.39	.0	.0	.0	1.53	248	13.2
6	do	Bluestone and potassium bichromate.			2.19	2.01	2.24	2.03	2.17	2.21	2.20	1.67	1.97	1.61	123	13.6
7	Oak bark				2.13	2.02	2.45	2.17	1.88	.19	.0	.0	.0	1.45	228	14.7
8	do	Bluestone and potassium bichromate.			2.11	1.95	1.99	2.17	2.10	2.15	1.71	1.97	1.95	1.50	145	14.0
9	Quebracho				2.15	2.03	2.32	2.03	2.19	2.13	.0	1.83	.0	1.65	206	13.0
10	do	Bluestone and potassium bichromate.			1.97	2.06	2.06	2.04	2.10	.41	.0	.0	.0	1.65	203	11.9
11	Quercitron				1.77	1.84	1.98	1.79	2.00	.42	.0	.0	.0	1.52	179	11.7
12	do	Bluestone and potassium bichromate.			2.00	1.96	1.95	2.16	2.07	2.18	2.11	2.15	2.03	1.58	134	12.6
13	do	Bluestone			2.09	1.97	2.00	1.55	1.82	.48	.0	.0	.0	1.472	237	14.2
14	do	Manganese chloride and potassium bichromate.			2.15	2.04	2.15	1.97	2.15	2.08	1.1	.46	.28	1.57	170	13.6
15		Zinc vitriol potassium bichromate.			2.16	2.02	2.14	1.93	2.10	2.03	1.34	.50	.0	1.57	188	13.7

16	Quercitron	Quercitron			2.01	1.99	2.20	2.21	2.08	.34	.45	.0	.0	1.55	216	13.1
17	do	do	Bluestone and potassium bichromate.		2.34	2.11	2.19	2.37	2.55	2.48	2.45	2.36	2.32	1.79	137	13.0
18	do	Bluestone and potassium bichromate.	Quercitron		2.15	2.15	2.19	5.15	2.19	2.27	2.36	2.15	2.06	1.65	191	13.1
19	do	do	do	Bluestone and potassium bichromate.	2.06	2.06	2.11	2.14	2.06	2.02	2.37	2.15	2.02	1.72	144	11.9
20	Catechu	do	Catechu		1.83	1.88	1.95	1.69	1.85	1.90	1.86	1.81	1.88	1.82	164	10.0
21	Coal tar and carbolineum.				2.09	1.88	2.13	2.02	2.16	1.32	.94	1.04	.44	2.697	85	7.8
22	Quercitron	Coal tar and carbolineum.			2.25	2.16	2.25	2.25	2.04	2.34	2.11	2.17	2.09	3.214	70	7.0
23	do	Wood tar			1.99	2.16	2.22	2.26	2.24	2.37	2.48	2.20	2.39	3.15	54	6.3
24	do	Bluestone and potassium bichromate.	Wood tar		1.99	2.01	1.53	1.95	1.95	1.95	1.9	2.0	1.99	3.5	49	5.7
25	do	do	Coal tar and carbolineum.		2.08	2.01	1.90	1.99	2.06	2.06	2.2	1.88	2.06	3.45	45	6.0

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[a] By "breaking length" is to be understood the length of thread, expressed in kilometers, required to cause the thread to break of its own weight.

Lime may also be used as a mordant or fixer for the tanning material. The lime is applied in the form of a solution as follows: Add slacked lime to water in a large container, and let stand with occasional stirring for several days. The clear liquor that remains after the excess lime has settled is to be applied to the nets in lieu of the potassium-bichromate-and-bluestone solution in the method to be given below, after they have been barked. No measurements of the strength of nets so preserved have been found.

A rather elaborate process of tanning employing lime fixation is described in an article in Norsk Fiskeritidende (1886). A translation of this article by Herman Jacobson was published in the Bulletin of the United States Fish Commission (Vol. VI, No. 7, June 12, 1886, pp. 97–104). The method consists of three applications of catechu, one of lime water, and a final treatment of a mixture of Stockholm (pine) tar and coal tar. That method appears to be too elaborate for use in the fisheries of to-day. A point of value in this paper, however, is that where more than one bath of the tanning extract is used the first one should be much weaker than the others.

IMPROVED RECIPE FOR TANNING NETS.

This section of the paper, treating preservation by tanning materials, is to be concluded with a recipe regarded as the best, and a summary. The recipe, given by Bull (1902), is:

> To 220 pounds of net (cotton or hemp, the method is best suited to cotton) take 33 pounds of solid extract of quercitron, or 143 pounds of oak bark. (Catechu does not give such good results, but if used, take 53 pounds.)
>
> The extract is boiled[a] until dissolved in 130 gallons of water. Stir continuously in the vessel to prevent the extract from burning to the bottom; the warm solution is poured over the net, which is laid in the vessel. With a flat board, if necessary, push the net down under the liquor. Cover the vessel well with a tarpaulin or sail canvas so that it can cool off only very slowly. After the vessel is completely cooled off the net is taken out and as much of the water as possible is wrung out before beginning the after treatment. If this is done at once, without preliminary drying, some of the tannin will dissolve out and the net will lose.
>
> The after treatment is carried out as follows: To 220 pounds of net take 2⅕ pounds bluestone and 3⅓ pounds potassium bichromate, and dissolve them in 150 gallons of cold water.[b] After the substances are entirely dissolved and the whole stirred well, the net is put into the bath. It is best to move the net about in the liquid from time to time so that it works evenly on the entire net. In this bath the color of the net is much darkened; if quercitron is used a uniform brown color is produced, like that of a barked net that has been used a long time. After two hours the net is taken out.
>
> It is the safest plan now to wash the net in water—for example, by putting it in a tub—but perhaps this is not necessary, so it can be spread out at once to dry, or be taken aboard. The water from the after treatment is quite worthless, for the salts added have been completely used up.

By way of comment it may be remarked that the best way to dissolve the extract is to put it in a coarse bag and to suspend the bag in hot water. This prevents débris from going into the solution. In heating the large amount of water the exhaust steam from an engine, or any other steam of a pound or two pressure may be used.

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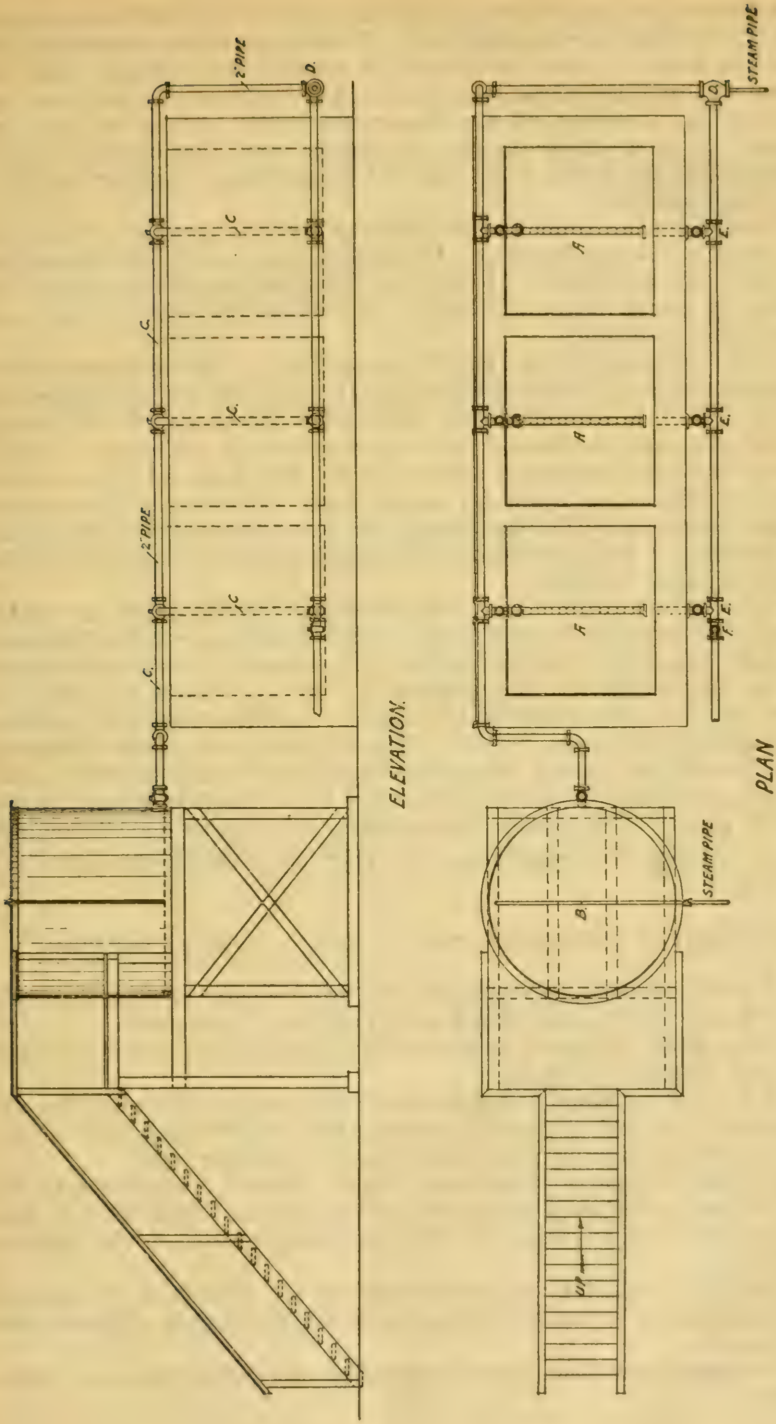
[a] The advisability of boiling the tan liquor is disputed. It appears the safer procedure to heat the water during the process of dissolution of the extract to about 175° F. (80° C.).

[b] Bluestone attacks metal vessels, and it should, therefore, be dissolved in barrels or other wooden vessels.



Plant for tanning nets. (From Barclay, 1905b.)

The accompanying drawing (Barclay, 1905*b*) represents a plant as used in Scotland for barking nets. Catechu or other extract is dissolved in tank *B*, which is heated by steam from a steam pipe. A system of pipes, the arrangement of which is obvious in the drawing, provides for drawing off the liquor into tanks where the nets are treated. *D* is a steam injector or siphon used for convenience in transferring the liquor from one vat to another, or returning it to the dissolving tank.

It is assumed in these recipes that the nets are perfectly clean and free from oil before tanning. Preferably, nets should be tanned before they are ever used. If they are dirty or greasy they should be washed in warm water and soap, well rinsed in warm water, and dried before tanning.

It will be noticed from Bull's figures that a double treatment of quercitron extract before mordanting (experiment No. 17) gave best results. If it is desired to do this—and this procedure is recommended—the first tan should be much weaker than the second; that is, use half the total amount of quercitron for first bath, add the remaining half to the same liquor for second bath, following with mordant, or after treatment. The net should be dried between first two baths of quercitron. This procedure is in keeping with the practice in the leather-tanning industry.

While this method is usually referred to in the literature as "Bull's method," it should be stated that an after treatment with a chromate (sodium chromate) was used before; for example, mention was made of it in the article in the Allgemeine Fischerei-Zeitung (1896) referred to, and potassium bichromate in combination with catechu was tested by Lindeman (1897). Olaus Tyskø, in a paper submitted in the Trondhjem contest, states that the method using catechu, copper sulphate, and potassium bichromate had been "used in Fosen for the last 20 years." (Konserveringsmidlers indflydelse paa fiskegarnstraad. Tillæg til Årsberetning for 1898 fra Trondhjems fiskeriselskab, pp. 4–7.)

SUMMARY OF METHODS OF PRESERVATION OF NETS BY TANNING.

1. Tanning methods are suitable for preservation of nets, leave the nets soft and pliable, and afford a high degree of protection.
2. Very little increased protection is afforded by treating tanned nets with lineseed oil or tar.
3. An after treatment of potassium bichromate following the application of tan liquor greatly increases the preserving power of tanning materials, such as quercitron, catechu, gambier, etc.
4. Copper sulphate (bluestone, copper vitriol) contributes to the color of nets when used as an adjunct to tanning methods, but does not add much, if anything, to the protecting power of the tanning material.
5. So far as the data go, hemp threads are protected by tanning materials just as is cotton, but not such a great degree of protection is afforded.
6. No data have been found regarding the preservation of linen thread.

7. All the methods of tanning impart a dark color to the nets, which color may be advantageous in making the nets less conspicuous in the water.

PRESERVATION OF NETS BY METHODS NOT DEPENDENT ON TANNING MATERIALS.

The methods of prolonging the life of nets which make no use of tanning materials, or make use of them only as adjuncts, employ linseed oil, pine tar, coal tar, bluestone, soap and bluestone, salt, smoke, and creosote.

Of these, linseed oil and tars are physical protections to the net; they fill up the spaces between the fibers and to a large extent keep the water from coming into contact with the materials of which the threads are composed. Naturally these materials are very efficacious, but that there are many and serious objections to the general use of linseed oil and tar will appear later. Linseed oil will be considered first.

LINSEED OIL.

For practical purposes the animal and vegetable oils are looked upon as being divided into two principal groups, the nondrying oils and the drying oils. The nondrying oils, of which coconut, peanut, cottonseed, and olive oils are examples, are used for soaps, foods, lubricants, and the like; they do not "dry"; that is, they do not form a skin upon being exposed to air, but under storage conditions may become rancid. The drying oils, such as linseed and menhaden oil, when exposed to air "dry"; that is, they form tough, somewhat elastic skins, which, when a pigment is incorporated with them, constitute paints. The conspicuous properties of these oils, that is, the turning rancid of the first class, and the drying to a skin of the second, are both traceable to the same cause—oxidation, or absorption of oxygen from the air. Both classes possess a keen appetite for oxygen, and the process of absorption is attended with the generation of heat; if the oil is distributed in such a way that great surface is offered for oxidation and at the same time little opportunity is afforded for the heat to escape, so much heat will be generated as to start a fire, as it is well known that oily rags will do, and also nets. Another peculiarity about this heating is that the hotter the rags or nets become, the faster the oxidation.

Linseed oil is the great drying oil, used the world over as the body for paints. It has been used in Holland (Barclay, 1904) for many years for preserving nets and to a considerable extent in the same way in England, particularly at Lowestoft and Yarmouth. This method, according to Cunningham, is simple: The nets are given one bath of catechu, thoroughly dried; and then one bath of linseed oil, drained, and dried. After drying, which takes two or three weeks or more, they are again bathed in catechu, which removes any undried oil. In use they are occasionally given a treatment of catechu, like any other net. The method, as used by the Dutch, according to Jessen (1903), is as follows:

> Any grease on the net is first removed in water, to which a little more than 2 quarts of slacked lime is added, per barrel of water. The net is then thoroughly dried, and introduced into a bath of 18 pounds catechu to 35 gallons of water; the water is boiled and stirred till the catechu is dissolved. The liquor

> is kept hot while the net is put into it. It is left in until the knots have had time to be thoroughly penetrated; then taken out, drained, and the moist net packed in a vessel till next morning, when it is taken out and dried very thoroughly. As soon as completely dry it is ready to receive the same treatment again, and so on until it has had 6 to 8 treatments, between each two of which it is thoroughly dried out, care being taken that the interior of knots is soaked at each treatment and dried with each drying.
>
> The net, perfectly dried, is now brought under raw linseed oil—1 pound of oil for each pound of net. The oil is kept as cold as possible. The excess of oil is drained off in a vessel with a false bottom. This done, the net is laid out in a field to dry, which drying takes two or three weeks or more. Much rain will injure the net, but under no circumstances should the net ever be heaped up until absolutely dry, even if it does rain. If it is heaped up it is certain to heat, and, aside from the danger of fire, it may be ruined by the heat generated.

There is no doubt that this is an excellent preserving method for nets and deserves all the esteem in which it has been held for so many years. But, because of its laboriousness and the present cost of linseed oil, it is not at all likely to receive consideration under present conditions in the United States. Neither is it every fisherman that has idle land on which he can lay out nets for three weeks or more to dry. Nor is the method necessary in many cases, for if the figures by Lindeman and Bull, given above, are reliable, the threads may be as well preserved by catechu or other tan, followed by a mordant, at much less cost and labor. The threads of hemp, preserved with catechu and mordant, were reduced in strength from 13.7 to 12.1 between first and third tests (28 weeks); preserved with catechu, mordanted, and then oiled, the figures are 10.9 and 13.2, or an apparent increase in strength. With cotton the results were similar, only both appeared to become stronger. But it will be noticed that the oiled nets are 50 per cent or more heavier than the other and the breaking length is correspondingly shorter.

Nets oiled with linseed oil are stiffer and harder than nets not oiled; in some cases, such as the gill nets for shad, this would be a serious objection; but for nets that stay constantly in the water, such as trammel or moored nets, oiling might be well justified. Cunningham said he left oiled nets in the water two months and found no diminution in strength in that time. Barclay (1905) concludes that improved tanning methods are good where there is opportunity for occasional drying of nets, but where there is no opportunity for drying it may be desirable to oil the nets after they are tanned or "barked."

TAR.

Preservation of nets by tar is the principal method used in the United States. The nets are simply passed through hot tar, freed from excess, and partially dried. On use the drying continues until the tar is hard and tough. Of this method Cunningham says:

> This method of treating a net is very cheap and tested by the method above described—breaking tests—on pieces of net exposed in a harbor, the preservation is very perfect. A piece of net lost scarcely any strength after two months in the water, and, moreover, a tarred net is distinctly stronger than a cutched net, because the dry tar increases the strength of the cotton fibers by gluing them together. As an antidote to putrefaction coal tar is perfect, no septic organisms being able to live in it. The fibers of the cotton, being covered by the tar, do not come actually into contact with water. For these reasons tar is an excellent preservative for coarse nets for rough use, such as trawl nets.

But for drift nets there are many objections to its use in the manner considered. The net is too rigid and stiff, and, therefore, does not usually mesh the fish well although to some extent the net is made more flexible by occasional dips in hot cutch, which softens the tar and removes a portion of it. The rigidity of the net causes it to wear out mechanically; after two or three years it is apt to give way at the knots, owing to the breaking of the stiffened fibers under the constant bending.

Another method sometimes used employs cutch and tar together, the tar being stirred into the hot cutch and the net bathed in the mixture. Cunningham found this to be very little better than the cutch or catechu alone, for the reason that the tar does not mix uniformly with the cutch, but breaks up into little droplets which attach themselves to the threads. The threads are therefore not uniformly protected by the tar.

Tar consists of two parts, a liquid part which is separately known as creosote, and a black, solid part which is left behind when the creosote evaporates. When the tar is first applied both are present, but as time passes the liquid creosote gradually evaporates, while the solid part remains. Both assist in protecting the nets, the solid by gluing the fibers together, the liquid by killing bacteria; one protects, the other preserves.

If in the table given by Bull (p. 20) the samples prepared with tar are compared with samples prepared in other ways, it is seen that tar holds its own against all rivals, if we consider preservation of breaking strength only. But it is noticed that weight is increased from around 1.6 grams per 10 meters to around 3.5, or about 2½ times; the breaking length is correspondingly reduced, while the absorption of water is reduced from about 250 per cent to about 50 per cent; that is, the amount of water the threads will absorb is reduced by the application of tar from about 2½ times its own weight to one-half its own weight.

The added weight of tar is a very material disadvantage in large nets, for it increases the labor of handling nets and prolongs the time of every move of the net. On the other hand, Bull's table shows that the tarred net soaks up much less water than the barked net and that, since absorbed water adds to the weight of the net just as tar does, the weight added by water must also be considered.

In the case of drift nets, where the poise of the net in the water is of greatest importance, the balance of the net has a bearing on the method of barking (Jessen, 1906). Jessen argues thus: A quantity of sea water of the same air and salt content and at the same temperature as that of the sea, will neither sink nor float, but will stay at whatever depth it is put, and when water thus soaks into a net it will tend neither to sink nor float the net, but is a dead weight. This dead weight, however, must be counterbalanced by a greater weight on the lead line than would be needed without it; that is, the weights on a water-logged net must be greater by an amount equal to the weight of the water in the net in order to keep the net vertical. Thus, if the untreated net in Bull's table took up 227 per cent water (No. 1) and required 24 kilograms stone sinkers, the barked net which took up 179 per cent water (No. 11) would require 21.6 kilograms sinkers, and with the barked and tarred net (No. 23) that took up 54 per cent of water, only 10.5 kilograms sinkers would be needed, and that with lead sinkers these figures are 14.6, 13.2, and 6.4 kilograms, respectively. Then, to show the practical force of his argument, he points out that with the untreated net (No. 1) with stone sinkers one must work with the weight of the net, 8.6 kilograms plus the water soaked up, 19.5 kilograms plus the stone sinkers, 24 kilograms, or 52.1 kilograms all together. While with the barked and tarred net and lead sinkers these weights are, net, tanning material and tar, 15.7 kilograms; absorbed water, 8.5 plus the necessary lead, 0.4 kilogram; a total of 30.6 kilograms. He also shows that the first net, requiring 17 men to handle it, can, if its weight is reduced by barking and tarring, be handled by only 10 men. No argument is required to show, also, that of two nets made of material exactly the same size and quality, but one weighted down to nearly twice the weight of the other, the heavier will wear faster than the lighter. While space does not permit of an extended review of the discussion of these matters,[a] it should be pointed out that Jessen appears to have overlooked the fact that if a tarred net of a weight of 3.15 increases in weight by 54 per cent, it will weigh 4.85 in all, while the untreated net of 1.45 will, when increased by 227 per cent, weigh 4.95, or more than the tarred one. Bull, in the article referred to in the footnote, gives the correct mathematics for making the calculations.

CUNNINGHAM'S FURTHER EXPERIMENTS.

At this point it is appropriate to introduce the remaining experiments conducted by Cunningham, using all the ordinary net preservatives in various ways.

PREPARATION OF SAMPLES.

1. Cutch alone (one-half pound cutch boiled in one-half gallon of water).—The pieces of net put in this until well soaked, then dried. Then put into cutch of same strength, steeped for two days, then dried.
2. Cutch and glue (one-half pound glue dissolved in 1 gallon of water).—The net dipped into this, then squeezed and put into hot cutch—one-half pound cutch to one-half gallon of water—then dried. Afterwards dipped a second time into cutch of same strength and dried again.
3. Cutch, glue, and bichromate of potash.—The net was dipped into glue, 1 pound to one-half gallon of water, with a little bichromate of potash added; then put into cold cutch and left to steep two days.
4. Cutch and copper sulphate.—The net was steeped two days in cutch, one-half pound to one-half gallon of water, then, while wet, put into copper sulphate, 1 pound to one-half gallon of water, and after a short soak rinsed in fresh water and dried.
5. Cutch and coal tar.—The net was first saturated with coal tar, then squeezed and wrung out several times with hot water, then dried for a week, and afterwards dipped in hot cutch, one-half pound to one-half gallon of water.
6. Cutch and coal tar mixed.—One-half pound cutch boiled in one-half gallon of water and then about a pint of coal tar stirred into the hot solution. The net was dipped into the hot mixture, then dried.
7. Cutch, tar, and green oil [a creosote distilled from coal tar].—The net was first steeped three days in cutch, one-half pound to one-half gallon of water. Then the same cutch was heated and the net passed hot from this through a mixture of coal tar, Stockholm [pine] tar, and green oil as thick as paint. The net was then passed through a wringing machine and dried.

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[a] See further, Bull (1906). Reference is made by Bull to a discussion of the matter between Dr. Johan Hjort and Peter Jessen in the Bergens Tidende, presumably in 1906.

8. Coal tar and green oil mixed.—The net was steeped in the mixture, then passed through a wringing machine, and hung up to dry.

9. Cutch and green oil.—The net was steeped several days in cutch, one-half pound to one-half gallon of water, then dried and put into green oil, then passed through a wringing machine and hung up to dry.

10. Green oil alone.—The net was simply saturated with green oil, passed through a wringer, and hung up to dry.

11. Cutch and Stockholm tar, mixed (one-half pound cutch boiled in one-half gallon of water, and one-half pint Stockholm tar stirred into the hot solution).—The net dipped into the mixture, squeezed out, and dried.

12. Cutch, Stockholm tar, and green oil.—The net was steeped three days in cutch, one-half pound to one-half gallon of water, then dried and soaked in Stockholm tar warmed, with a little turpentine added. As the net was very hard and sticky, it was soaked with green oil and passed through the wringing machine.

13. Cutch and linseed oil.—The net was steeped in cutch (one-half pound to one-half gallon of water) for three days, dried, and then dipped in boiled oil, with driers added. After some weeks it was dipped again in cutch and dried.

14. Soap and copper sulphate (one-half pound soap boiled in one-half gallon of water).—The net soaked in this and then put into a solution of copper sulphate, one-half pound to one-half gallon of water.

15. Soap, copper sulphate and linseed oil.—The net, prepared as in 14, was saturated with boiled oil, with driers added, and hung up to dry.

The pieces were all cut from the same mackerel net, 24½ rows to the yard. 12-ply, and the following table shows the results of testing:

Mode of cure.	Strength when dry.		Strength after 4 weeks in water.		Strength after 2 months in water.	
	Lbs.	*ozs.*	*Lbs.*	*ozs.*	*Lbs.*	*ozs.*
1. Cutch only, two dips and steeped	15	9	16	8	6	6
2. Glue and cutch, one dip in glue, two in cutch	17	2	9	6	....	....
3. Cutch, glue, and bichromate of potash	16	11	14	4	....	....
4. Cutch and copper sulphate	13	8	10	9	....	....
5. Cutch and coal tar, tarred first	18	4	21	0	18	0
6. Cutch and coal tar, mixed	17	12	18	6	8	1
7. Cutch, tar, and green oil, passed direct from the cutch into the tar	17	3	18	0	14	3
8. Coal tar and green oil, mixed	16	0	16	1	14	12
9. Cutch and green oil	15	14	18	4	17	0
10. Green oil alone	16	5	16	0	15	8
11. Cutch and Stockholm tar mixed	17	13	17	6	6	12
12. Cutch, Stockholm tar, and green oil	14	4	18	0	16	6
13. Cutch and linseed oil	15	1	16	12	15	8
14. Soap and copper sulphate	15	1	15	8	....	....
15. Soap, copper sulphate, and linseed oil	15	1	15	4	14	8

It is evident that Cunningham did not carry his tests far enough to give decisive indications. In spite of this insufficiency, it is plain that those methods are good which depend on tar or oil as a protective covering, where these substances really cover, but when they are broken up into tiny particles or applied to a wet net, as in Nos. 6, 7, and 11, little protection is given.

SHRINKAGE CAUSED BY PRESERVING.

Cunningham also kept a record of the shrinkage caused by the various methods of curing nets. As stated above, the nets were 24½ rows per yard before treatment. After treatment they varied according to the following list. (Of course, the greater the number of rows there are the more the shrinkage that has taken place.)

No.		Rows per yard.
1.	Cutch only	26¼
2.	Glue and cutch	25½
3.	Cutch, glue, and bichromate	25½
4.	Cutch and copper sulphate	25½
5.	Coal tar and cutch	28½
6.	Cutch and coal tar mixed	27
7.	Cutch, tar, and green oil	25½
8.	Coal tar and green oil	25½
9.	Cutch and green oil	26¼
10.	Green oil alone	25½
11.	Cutch and Stockholm tar	27
12.	Cutch, Stockholm tar, and green oil	25½
13.	Cutch and linseed oil	27
14.	Soap and copper sulphate	27
15.	Soap, copper sulphate, and linseed oil	27

All the methods caused shrinkage, the greatest being caused by coal tar and cutch, but the other combinations of cutch and tar caused marked shrinkage. All the tanning methods cause shrinkage, and the shrinkage increases with each application of the preservative.

To conclude the discussion of tar as a preservative, it can be said that tar effects excellent preservation, is comparatively inexpensive, and requires much less labor and time than, for example, the combination of catechu and linseed oil. For the heavier and coarser kinds of nets that are anchored or moored in the water, such as trammel or pound nets or nets that are handled by machinery, the method is well suited. But for gill nets, the method is not at all suited, and for even the heavier seines that are hauled by hand, consideration should be given to the extra weight added by tar and the consequently increased number of men necessary to handle nets so preserved. In such cases, especially for nets that can be dried occasionally, the more improved barking methods, such as quercitron and potassium bichromate, are likely to prove to be better and to be little more expensive or laborious than methods employing tar.

Tar should never be mixed with catechu solution or anything else containing water before application to the net and should never be applied to a wet net. It may be thinned with creosote, "green oil," turpentine, etc., without injury. If a net be cutched or barked before being tarred, it should be thoroughly dried before the tar is applied. While tar may be applied profitably to new, white nets, it seems likely that it will always yield a good return on the investment to tan the nets with quercitron and bichromate and to follow with a thorough drying before application of the tar.

CREOSOTE, SMOKE, ETC.

As stated above, tar consists of a solid and a liquid part. The liquid part really consists of a number of different liquids and volatile solids, such as carbolic acid, benzol (or benzene), napthalene, etc., mixed, which, when separated, have different important commercial uses. They are distilled off from coal tar. One portion (the third main portion distilling over at from 230 or 240 to 270° C.) is known as " green oil " or creosote oil, a greenish-yellow, oily liquid, heavier than water, and containing various antiseptic substances. It is used for the preservation of crossties, fence posts, telegraph and telephone poles, and has been used for the treatment of nets. Reference to Cunningham's table above shows that creosote oil alone is a good preservative for nets and causes little shrinkage; it also possesses this advantage, that it does not make nets stiff. The principal objection to its general use is that it washes out or evaporates rather rapidly from the net, and no method of fixing it is known. The net is oily or greasy for some time after it is treated and is therefore objectionable to handle.

Concerning the mode of application of creosote, Cunningham says:

> There are many different ways of applying the green oil or creosote to the nets; the net may be well cutched first, then dried, soaked in the green oil when dry, then passed through a wringing machine, and spread out to dry; or the net may be passed straight from hot cutch, without drying, through the green oil, and then dried, or, instead of the oil alone, a mixture of tar and green oil may be used. In whatever way it was applied I found pieces of net treated with green oil had lost but very little strength after two months' exposure in Newlyn Harbor.

The principal preserving matters in creosote that comes from wood go over in the smoke when the wood burns in a smoldering fire. Upon this fact is based a method using smoke.[a]

It is stated in the articles referred to that this method had been used on the Gulf of Courland for many years in houses that had no chimneys by allowing the smoke to go through passages into a loft where the nets were hung. A direct method of applying the smoke is to fasten the net to the underside of boards which are supported above a smoking wood fire.

While this method appears to be primitive, there is nothing chemically unreasonable about it, and it may be that under certain circumstances the method would be applicable to-day. It would certainly be much better than nothing, provided the nets were not allowed to be overheated during the smoking process. It would be necessary to repeat the treatment, perhaps several times a year. The method has the advantage of depositing upon the fibers the volatile antiseptic substances of tar, without the heavy thick parts, and it would appear less likely to shrink the nets.

COPPER SULPHATE.

It was noticed in the figures of Lindeman, given above, that hemp threads were improved by every method that improved cotton threads; only one preserving material had a more marked effect on hemp than on cotton—that is, copper sulphate (or copper vitriol, bluestone, blue vitriol, etc., as it is variously known). This substance has long been used for nets, alone or in combination with other substances. According to a quotation in the Norsk Fiskeritidende (1906) this is used in Norway for the treatment of salmon nets. One kilogram (2½ pounds) of copper sulphate is dissolved in a barrel of water. The nets are treated with this by allowing them to lie in it overnight. They are put into the sea as soon as they are taken from the bath, without preliminary drying. Lindeman's figures show that the method does not deserve serious consideration.

What is perhaps of much more importance is a method of using copper sulphate in combination with soap. A method of this kind is said to have been used in the French sardine industry to give the nets a color. Oils consist of two parts, glycerin combined with fatty acids. When the glycerin is taken out, and soda or potash substituted for it, ordinary soaps are produced. If, instead of the alkalis, any other metal—such as copper, mercury, aluminum, etc.—is used, insoluble soaps—such as copper soap, mercury soap, aluminum soap, etc.—are produced. The simplest method of preparing these "heavy metal soaps" is first to make ordinary soap, then treat it in solution with a compound of the metal whose soap is desired. Thus, if to a solution of ordinary soap aluminum chloride is added, an insoluble waxy precipitate falls—aluminum soap; if copper sulphate is employed instead of aluminum chloride, a bright green, insoluble copper soap is formed. The insoluble calcium soap is a very familiar substance formed when soap is dissolved in "hard" water—a tallowy stuff that gets on one's hands, the bathtub, etc. This is calcium or lime soap. A similar soap is used for temporary calking of small leaks in boats; a soap of aluminum is used to waterproof clothing, for it makes clothes difficult to wet, the water rolling off "like water from a duck's back."

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[a] See Mittheilungen des Westpreussischen Fischerei-Vereins (1896), Deutscher Fischerei-Verein (1885), and Norsk Fiskeritidende (1896).

Now, if the principal reason for using copper to preserve nets is that it kills bacteria and other injurious living things, and if the principal objection to its use as bluestone is that it washes out so readily, there will be no difficulty in seeing that the object of using it in the form of a soap is to take advantage of its protective property and at the same time to prevent it from escaping into the water. Since copper soap is quite insoluble in water, there would be no way to get it into the fibers if it were made before it is applied; it is therefore necessary to cause the copper soap to be produced inside the fiber by impregnating the threads first with soap solution and then with copper sulphate. In the practice of preserving nets the following process, according to Cunningham, is used:

> To treat a net by this process from one-half to three-fourths pound of ordinary soap, such as mottled soap * * * is used for each gallon of water, and the soap is dissolved by boiling in a copper or in a galvanized bath over a fire. The net is then soaked in the soap solution, taken out, squeezed through the hands, and allowed to drain. The copper sulphate, which is also known as blue vitriol or bluestone, must not be dissolved in an iron vessel, as it will attack and dissolve the iron. It must be put into a wooden or earthenware vessel, and it is not necessary to use heat to dissolve it, as it will dissolve in cold water if stirred up for a short time. The net while still hot from the soap solution is then passed through or put into the solution of bluestone, and the whole net becomes uniformly green. The net is then rinsed in cold water. About three-fourths pound of bluestone to a gallon of water is the proportion required.

This method preserves the net, according to Cunningham's figures, for about four weeks, but he says that after two months the sample treated was quite rotten. The process can, of course, be repeated as often as necessary, and by repeated treatments a net should be kept in condition for years. It causes strong shrinking of the net.

A similar method is recommended for ropes and canvas by the Norsk Fiskeritidende (1887). The procedure there given is as follows:

> Ropes are laid first for four days in a solution of copper vitriol (20 grams to a liter of water—two-thirds ounce to a quart) and then dried. They are then tarred in the usual way or laid in a soap solution (100 grams to a liter of water—3⅓ ounces to a quart) until they are saturated through. Canvas is treated only with the vitriol and soap.

GENERAL COMMENTS.

Only the more important and widely used or promising processes for the preservation of nets have been considered. To anyone who has searched literature it would be a surprise if a great many other methods and processes were not found to have been tried. The list given by Jessen includes, besides barking, smoking, alum, train oils, tallow, grease, bluestone, potassium bichromate, various compounds of mercury, iron vitriol, pine tar, wood oils, coal tar, aniline dyes, and various other products of gas works, salt, resins, soaps, lime, etc. But all the recorded data found that will have a material value have been included in this paper.

It should be obvious to most people that nets should always receive some preservative treatment. Coarse nets, pound nets, and the like should be both barked with catechu or quercitron, mordanted with potassium bichromate, and then tarred. Where it is not possible or suitable to tar the nets, they should receive the catechu or quercitron treatment and the mordant. It is preferable to use two baths of quercitron, the first containing only one-half the total amount to be used.

Though no actual figures have been brought forth to prove it, there is little doubt that nets are destroyed more rapidly in warm climates and warm weather than in cold. Fishermen should take note of this fact and be accordingly more careful of their nets where the weather is warm. It is also likely that foul, dirty water works more rapid destruction on nets than clean water.

One of the possible ways to avoid the disintegration of nets is, of course, the chance of using some material that is not subject to decay—metals, for example. A person signing the initials C. J. (1912) describes briefly in the Dansk Fiskeritidende some experiments with aluminum, brass, copper, and galvanized-iron wire for bow nets. The aluminum proved to be best.

No important results have come from efforts to substitute metals for plant fibers for nets.

CARE OF NETS.

When nets are piled up wet—especially if they are foul with slime, blood, fat, etc.—the rapid oxidation heats the net. Even if the net does not take fire the heat generated may very well cause a great weakening. This weakening will not be visible, but will tell in a much shorter life of the net. However carefully the net is barked or tarred, a very short life can be looked for if the net has been heated.

For a temporary preservative, where it is not possible to dry the nets, it is customary to salt them. This is a useful treatment, as far as it goes. Salt is not in itself poisonous or injurious to small organisms or bacteria (for they live in the sea which contains much salt) if the concentration is not too great. But it is well known that when any watery organism is exposed to a salt solution stronger than its own juice water will be extracted and usually the organism dies. The salt is injurious to living things not because of its saltiness, but because of its concentration; not because it is poisonous, but because it extracts the water necessary for things to live on. The rule is that a stronger salt solution will extract water from a weaker juice whereever it comes in contact with it.

This principle is made use of in many ways. Every fisherman knows that salt draws the water out of fish in the curing process. It is not so apparent, but it is equally true, that it draws the water from and kills the bacteria that would otherwise cause the fish to decay, and thus preserves it. Any equally concentrated substance would do the same. Thus sugar is used in very concentrated sirup to preserve fruits; if the preserves were sufficiently diluted with water, bacteria could live in them and they would spoil.

In this way salt preserves nets. It dissolves in the moisture on the threads to make a very strong solution; this strong solution kills bacteria and other small organisms by extracting the water from them. From this it is hardly necessary to say that the salt should be applied generously, and preferably in the dry condition, to a wet net. If brine is used, it should be very strong.

But salt will not prevent heating in an oily net that has just caught very fat fish, such as herring. The heating is caused by the air working on the fat. The only way to prevent this heating is either to get rid of the fat or to prevent the air from getting to it. Aboard a vessel it is not always convenient to wash the net out immediately, nor is there room to spread the net (if spread, the heat, of course, escapes as fast as produced and no harm is done). Bull (1905) suggests that to prevent this heating of recently used herring nets aboard a vessel, there be provided a wooden tank with a tight-fitting lid, filled with water or salt solution, and that the net be put into this and covered over with the lid until there is opportunity to wash it. The water or salt solution keeps out the air and prevents heating. The cheapest obtainable grade of salt may be used, since there is not likely to be anything in it that is injurious to nets.

Nets, as every fisherman knows, should be washed and dried at every opportunity.

CONCLUSION.

The most important methods of preserving nets are tanning, for which an improved recipe is given on page 22; tarring, found on page 26; and creosote, found on page 30. Other methods are also given.

CITATION OF LITERATURE.

In the preparation of this paper the following publications have been consulted and material therein quoted or reproduced here and translated where necessary. Those interested in pursuing the subject are referred to them for further details.

Aase, Hans.
1912. Barkning. Norsk Fiskeritidende, 31de Aargang, pp. 169–172, 1912. Bergen.

Barclay, M.
1904. Barkning og Oljing af Sildegarn paa hollandsk Maade. Norsk Fiskeritidende, 23de Aargang, pp. 448–458, 475–485, 1904. Bergen.
1905*a*. Om Barkningsmetoder. Referat fra Fiskermødet paa Sortland den 11te og 12te Juli, 1905; ved M. H. Stoltz. Norsk Fiskeritidende, 24de Aargang, pp. 233–239 (discussion of paper, pp. 238–239), 1905. Bergen.
1905*b*. Sildegarnenes Konservering i England og Skotland. Norsk Fiskeritidende, 24de Aargang, pp. 372–376, 1905. Bergen.

Bull, Henrik.

1901. Om Barkning af Garn. Norsk Fiskeritidende, 20de Aargang, pp. 863–872, 1901. Bergen.

1902. Barkning af Garn. Norsk Fiskeritidende, 21de Aargang, pp. 401–404, 1902. Bergen.

1905. Om Opbevaring af Garn ombord. Norsk Fiskeritidende, 24de Aargang, p. 207, 1905. Bergen.

1906. Om vore Drivgarn og deres Belastning. Norsk Fiskeritidende, 25de Aargang, pp. 195–203, 1906. Bergen.

1912. Hvad Slags Barkestof skal man kjøbe for Barkning af Garn? Norsk Fiskeritidende, 31de Aargang, pp. 39–40, 1912. Bergen.

Cunningham, J. T.

1902. The chemistry of net-curing. Fish Trades Gazette and Poultry. Game and Rabbit Trades Chronicle, Vol. XX, No. 993, p. 29; No. 994, p. 29; No. 995, p. 29; No. 996, p. 29; No. 997, p. 27; No. 998, p. 31; No. 999, p. 31; No. 1000, p. 31; No. 1001, p. 31; No. 1002, p. 31; No. 1003, p. 25; No. 1004, p. 27; No. 1005, p. 31; No. 1006, p. 31; No. 1007, p. 37; No. 1008, p. 31; No. 1009, p. 31; June–September, 1902. London.

Deutscher Fischerei-Verein.

1885. Mittel zur Conservierung von Fischnetzen. Mittheilungen der Section für Küsten und Hochseefischerei, No. 1, pp. 34–35, 1885. Berlin.

J——, C.

1912. Forsøg med Metaltraadsnæt. Dansk Fiskeritidende, N. R. 10de Aargang, p. 488, 1912. København.

Jessen, Peter.

1903. Det hollandske Drivgarn. Norsk Fiskeritidende, 22de Aargang, pp. 395–407, 1903. Bergen.

1906. Om Konservering af Garn og Not. Norsk Fiskeritidende, 25de Aargang, pp. 151–159, 1906. Bergen.

1910. Fiskenes Farvesans og sjøfarvede Garn. Norsk Fiskeritidende, 29de Aargang, pp. 219–222, 1910. Bergen.

Lindeman, Thv.

1897. Om konserveringsmidlers indflydelse på fiskegarnstråd. Årsberetning fra Trondhjems fiskeriselskab for budgetterminen, 1st juli, 1896–30te juni, 1897. Trondhjem.

Mittheilungen des Westpreussischen Fischerei-Vereins.

1896. Zur besseren Haltbarkeit der Netze. Allgemeine Fischerei-Zeitung, XXI Jahrg. No. 3, pp. 44–45. 1896. München.

Norsk Fiskeritidende.

1886. Bevaring af Garn. Norsk Fiskeritidende, 5te Aargang, pp. 138–151, 1886. Bergen. (A translation by Herman Jacobson, appeared in the Bulletin of the U. S. Fish Commission, Vol. VI, No. 7, pp. 96–104, 1886. Washington.)

1887. Bevaring af Tougværk og Seildug. Norsk Fiskeritidende, 6te Aargang, p. 295, 1887. Bergen.

1896. Praktisk Konserveringsmiddel for Nøter og Garn. Norsk Fiskeritidende, 15de Aargang, pp. 647–648, 1896. Bergen.

1906. Behandling of Fiskenøter med Blaasten. Norsk Fiskeritidende, 25de Aargang, p. 251, 1906. Bergen.

Reeves, Cora D.

1919. Discrimination of light of different wave-lengths by fish. Behavior Monographs, Vol. 4, No. 3, 1919, Serial No. 19, 106 pp. (Bibliography). Cambridge, U. S. A.

AN ANALYTICAL SUBJECT BIBLIOGRAPHY OF THE PUBLICATIONS OF THE BUREAU OF FISHERIES

1871-1920

By Rose M. E. MacDonald
Librarian, U. S. Bureau of Fisheries

Appendix V to the Report of the U. S. Commissioner of Fisheries for 1920

LETTER OF TRANSMITTAL.

Department of Commerce,
Bureau of Fisheries,
Washington, June 15, 1920.

Hon. Hugh M. Smith,
Commissioner of Fisheries.

Dear Sir: I have the honor to submit herewith "An Analytical Subject Bibliography of the Publications of the Bureau of Fisheries, 1871-1920," being an analysis of the reports, appendixes, special papers, bulletins, economic circulars, occasional papers, and of "The Fisheries and Fishery Industries."

Covering the investigations of the Bureau since its incipiency, it shows, in a measure, the work of a number of men of no mean fame in the field of biology. Much of it was pioneer work, which modern investigators can not afford to ignore.

The work here transmitted was started in 1912, as a catalogue of the publications of the Bureau. Later it was decided to assemble these titles under subjects pertinent to the work of the Bureau.

In compiling this subject index it was found that references to many valuable results would be lost unless a meticulous analysis of the publications be made. Each paper was therefore examined searchingly, and when the discussion was found to be of sufficient detail, a title for it was made. For instance, of the 141 titles of *Food of fishes*, 87 were made from the subject contents.

It had long been realized and often stated by those cognizant of the ideals of the Bureau that there was a veritable fund of valuable information in the publications of the Bureau, which was lost because the modern investigator knew not how to find it. It is hoped that this work will prove a valuable key.

The arrangement differs from that usually employed in bibliographies, the object having been to arrange it from the viewpoint of the investigator. In a work of such detail, the preparation of which has necessarily extended over several years, some mistakes will doubtless appear. For these I am quite willing to assume responsibility, knowing that a bibliography of such magnitude can not be perfect.

In its entirety it stands as a slight tribute to the builders of the Bureau of Fisheries and to all who have labored with them. It has been a pleasure and an inspiration to do the work, and I hope it may prove of value. I have the honor to be,

Very respectfully,

Rose M. E. MacDonald, *Librarian.*

AN ANALYTICAL SUBJECT BIBLIOGRAPHY OF THE PUBLICATIONS OF THE BUREAU OF FISHERIES, 1871-1920.

By Rose M. E. MacDonald, *Librarian.*

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[a] Analytical subject table of contents is given with each part, except in parts 3 and 6, where it is given with each section.

EXPLANATORY NOTE.

The bibliography is composed of two styles of titles, those given just as they appear in the publications and those resulting from the analysis of each article. For the first style, cards have been printed by the Library of Congress from copy prepared in this Bureau. These cards may be purchased from the Library of Congress, the card wanted to be designated by the call number, which appears in the right-hand margin of each page. The second style, or "made titles," are designated by brackets and have no printed cards.

The arrangement under each subject is by authors listed alphabetically. The arrangement under each author is chronological.

Work or investigations covered in the annual report of the Commissioner are combined under the authorship of the United States Commissioner of Fisheries. To give the name of the Commissioner sponsoring the work would frequently destroy the chronological arrangement. For those who may care to cite the Commissioner's name the following list is given:

Baird, Spencer Fullerton, 1871–1887.
Goode, G. Brown, 1887–1888.
McDonald, Marshall, 1888–1895.
Gill, Herbert A. (acting), 1895–1896.
Brice, John J., 1896–1898.
Bowers, George M., 1898–1913.
Smith, Hugh M., 1913–

For the purpose of chronological arrangement, divisional reports are given under the authorship of the United States Bureau of Fisheries.

In anaylzing reports (meaning also appendixes and special papers) and bulletins, the analysis in each case has been of the bound volume, and the date of issue given for each title is therefore that of the volume. In the majority of cases, however, the articles comprising the bound volume are first issued as separates. In all such instances, in addition to the date of issue of the volume, the date of issue of the article as a separate is given in italics. The one exception is in the treatment of the annual reports, page 7, where the date of issue of the separate only is given.

Being an analysis of publications of the Bureau of Fisheries only, which are always printed in Washington and, with few exceptions, by the Government Printing Office, the place of publication is omitted in every case, and the printer given only in the exceptions.

Part 1.—UNITED STATES BUREAU OF FISHERIES.

Part 1.—UNITED STATES BUREAU OF FISHERIES.

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[a] For "Fish-cultural stations" and "Cars" see Part 3, Section 2. For "Vessels" see Part 2.

PART 1.—UNITED STATES BUREAU OF FISHERIES.

HISTORY.

Brice, John J.: The work of the United States Fish commission from December 1, 1896, to November 3, 1897. Bulletin, 1897 (1898), vol. XVII, p. 135–139. *Doc. 354 issued Feb. 4, 1898.* F12–243

Goode, George Brown: The first decade of the United States Fish commission, its plan of work and accomplished results, scientific and economical. Report, 1880 (1883), p. 53–62. F16–23

——— Ibid. Bulletin, 1881 (1883), vol. II, p. 169–178. F12–356

Smiley, Charles Wesley: Four tables, showing the amount of public money appropriated for carrying on the United States Commission of fisheries, and the various State commissions, from 1865 to 1882, inclusive. Bulletin, 1883 (1883), vol. III, p. 140–152. F18–122

——— The organization and personnel of the United States Fish commission, June 1, 1883. Bulletin, 1883 (1883), vol. III, p. 115–116. F18–117

Smith, Hugh M.: The United States Bureau of fisheries, its establishment, functions, organization, resources, operations, and achievements. 80 p., front. (ports.), illus. *Doc. 641 issued September, 1908.* 8–35683

——— Idem. Bulletin, 1908 (1910), vol. XXVIII, p. 1365–1411, front. (ports.), illus. *Doc. 725 issued May 10, 1910.*

U. S. Bureau of Fisheries: Directory of officers, collaborators, employees, etc., of the Smithsonian institution, National museum, Geological survey, and Fish commission. 8 p. *Doc. 39 issued June, 1882.* F14–134

——— U. S. Commission of fish and fisheries. Laws and regulations. 32 p. *Doc. 49 issued June 26, 1882.* F12–240

——— [Origin and functions.] Printed for distribution at the Lewis and Clark centennial exposition, Portland, Oregon, 1905, by the U. S. Department of commerce and labor, section of the Bureau of fisheries. 6 p., illus.

——— [Origin and functions.] Printed for distribution at the Ter-Centennial Exposition, near Norfolk, Va., 1907, by the U. S. Bureau of fisheries. 1907. 10 p.; illus.

ANNUAL REPORTS.

U. S. Commissioner of Fisheries: Annual report, 1871 and 1872, *Doc. 3 issued 1873*, 1872 and 1873, *Doc. 4 issued 1874;* 1873–74 and 1874–75, *Doc. 15 issued July 24, 1876;* 1875 and 1876, *Doc. 17 issued 1879;* 1877, *Doc. 25 issued Oct. 17, 1879;* 1878; *Doc. 28, issued 1880;* 1879, *Doc. 46 issued June, 1882;* 1880, *Doc. 62 issued 1883;* 1881, *Doc. 65 issued Jan. 22, 1884;* 1882, *Doc. 77 issued Aug. 15, 1884;* 1883, *Doc. 95 issued Dec. 19, 1885;* 1884, *Doc. 108 issued Nov. 24, 1886;* 1885, *Doc. 115 issued May 16, 1887;* 1886, *Doc. 134 issued 1889;* 1887, *Doc. 176 issued Dec. 1, 1891;* 1888–89, *Doc. 192 issued 1893;* 1889-1891, *Doc. 213 issued 1893;* 1892, *Doc. 283 issued Dec. 26, 1894;* 1893, *Doc. 298 issued May 28, 1896;* 1894, *Doc. 315 issued 1896;* 1895, *Doc. 331 issued Jan. 6, 1897;* 1896, *Doc. 337 issued May 29, 1897;* 1897, *Doc. 344 issued Feb. 21, 1898;* 1898, *Doc. 398 issued Mar. 16, 1899;* 1899, *Doc. 430 issued Sept. 8, 1900;* 1900, *Doc. 450 issued Dec. 15, 1900;* 1901, *Doc. 481 issued June 30, 1902;* 1902, *Doc. 524 issued Apr. 16, 1903;* 1903, *Doc. 548 issued May 9, 1904;* 1904, *Doc. 553 issued Jan. 11, 1905;* 1905, *Doc. 594 issued Jan. 19, 1906;* 1906, *Doc. 608 issued Dec. 31, 1906;* 1907, *Doc. 629 issued Dec. 13, 1907;* 1908, *Doc. 642 issued Dec. 23, 1908;* 1909, *Doc. 727 issued Feb. 12, 1910;* 1910, *Doc. 734 issued Nov. 25, 1910;* 1911, *Doc. 753 issued May 4, 1912;* 1912, *Doc. 772 issued Feb. 1, 1913;* 1913, *Doc. 78 issued Jan. 27, 1914;* 1914, *Doc. 807 issued Dec. 9, 1914;* 1915, *Doc. 827 issued Dec. 24, 1915;* 1916, *Doc. 836 issued Dec. 16, 1916;* 1917, *Doc. 845 issued Dec. 6, 1917;* 1918, *Doc. 862 issued Dec. 11, 1918;* 1919, *Doc. 877 issued Dec. 11, 1919;* 1920, *Doc. 894 issued Dec. 16, 1920.* F10–2–3

PUBLICATIONS.

Scudder, Charles W.: A list of the blank forms, circulars, and minor publications of the U. S. Fish commission from August 1, 1883, to August, 1884. Bulletin, 1884 (1884), vol. IV, p. 397–400. F18–350

——— List of publications of the United States Fish commission from its establishment in February, 1871, to February, 1896. Report, 1894 (1896), p. 617–706. *Doc. 329 issued Dec. 14, 1896.*

Smiley, Charles Wesley: List of papers relating to the work of the United States Fish commission from its organization in 1871, to July 1, 1883, and which have been published under the direction of the United States Fish commission, National museum, and Tenth census, together with a topical synopsis of the titles. Bulletin, 1883 (1883), vol. III, p. 1–85. F18–114

——— A list of the blank forms, circulars, and minor publications of the United States Fish commission from its organization in 1871 to August 1, 1883. Bulletin, 1883 (1883), vol. III, p. 129–148. F18–121

——— Chronological list of pamphlet publications of the U S. Fish commission from its organization in 1871 to January, 1885. Bulletin, 1885 (1885), vol. V, p. 41–48. F18–376

U. S. Bureau of Fisheries: Publications of the United States Commission of fish and fisheries available for distribution on June 30, 1897. Appendix 7, Report, 1896 (1897), p. 343–356. *Doc. 354 issued Feb. 4, 1898.*

——— Publications of the United States Commission of fish and fisheries available for distribution on March 1, 1899. Report, 1899 (1900), p. 313–327. *Doc. 406 issued Mar. 28, 1899.*

——— Publications of the United States Commission of fish and fisheries available for distribution on June 30, 1903. Report, 1903 (1905), p. 529–551. *Doc. 552 issued Oct. 27, 1904.*

——— List of publications of the Bureau of fisheries available for distribution. *Doc. 614 issued Sept. 4, 1907; Jan. 23, 1908; Apr. 25, 1908; Dec. 21, 1908; Mar. 20, 1909; May 7, 1910; Feb. 19, 1911; Aug. 15, 1913; Oct. 20, 1914; July 17, 1915; May 26, 1916.*

LABORATORIES.

BEAUFORT, N. C.

HISTORY.

U. S. Bureau of Fisheries: The Bureau of fisheries and its biological station at Beaufort, N. C. 1916. 11 p., illus. [Occasional papers.] F16–104

U. S. Commissioner of Fisheries: [Establishment of station.] Report, 1901 (1902), p. 14–15.

——— [Description of laboratory.] Report, 1903 (1905), p. 14–15, illus.

——— [Improvements and repairs.] Report, 1915 (1917), p. 34–35.

BRIEF MENTION OF WORK.

U. S. Commissioner of Fisheries: Report, 1905 (1907), p. 26; 1906 (1908), p. 15; 1908 (1910), p. 11; 1909 (1911), p. 16; 1910 (1911), p. 19; 1911 (1913), p. 23; 1912 (1914), p. 57; 1913 (1914), p. 31–32; 1915 (1917), p. 35; 1918 (1920), p. 28; 1919 (1921), p. 29.

RÉSUMÉ OF INVESTIGATIONS.

Smith, Hugh McCormick: [Investigation for 1898–1903.] Report, 1899 (1900), p. CXLII–CXLIII; 1900 (1901), p. 125–126; 1901 (1902), p. 131–132; 1902 (1904), p. 138; 1903 (1905), p. 99–100; 1904 (1905), p. 118–120.

U. S. Commissioner of Fisheries: [Report of investigation for 1906.] Report, 1907 (1909), p. 12–13.

——— [Report of investigations for 1913.] Report, 1914 (1915), p. 68–69.

——— [Service of the Beaufort laboratory.] Report, 1916 (1917), p. 46–47.

FAIRPORT, IOWA.

HISTORY.

Coker, Robert Ervin: The Fairport fisheries biological station: its equipment, organization, and functions. Bulletin, 1914 (1916), vol. XXXIV, p. 383–405, illus., pl. LXXVI–LXXXI. *Doc. 826 issued July 7, 1916.* F16–131

——— The Fisheries biological station at Fairport, Iowa. Appendix I, Report, 1920 (192–). *Doc. 895 issued 1921.*

U. S. Commissioner of Fisheries: [Fisheries laboratory at Fairport.] Report, 1914 (1915), p. 69–70; 1915 (1917), p. 33–34.

——— [Service of Fairport laboratory.] Report, 1916 (1917), p. 47–48.

——— [Destruction by fire.] Report, 1918 (1920), p. 28.

Wilson, Charles Branch: [Description of ponds at Fairport.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 186–188.

BRIEF MENTION OF WORK.

U. S. Commissioner of Fisheries: Report, 1911 (1913), p. 20; 1912 (1914), p. 57; 1913 (1914), p. 32; 1916 (1917), p. 47–48; 1917 (1919), p. 87; 1918 (1920), p. 28; 1919 (1921), p. 28.

KEY WEST, FLA.

HISTORY.

U. S. Commissioner of Fisheries: [Acquisition of land and plans for laboratory.] Report, 1916 (1917), p. 47.
——— [Construction started.] Report, 1917 (1919), p. 87.

BRIEF MENTION OF WORK.

U. S. Commissioner of Fisheries: Report, 1918 (1920), p. 28; 1919 (1921), p. 28.

WOODS HOLE, MASS.

HISTORY.

Baird, Spencer Fullerton: The Woods Hole station. (Records, inception, rise, progress, and current condition.) Report, 1882 (1884), p. XXXVIII–XLI; 1883 (1885), p. LIII–LVI; 1884 (1886), p. XXXVII–XXXIX; 1885 (1887), p. XLIX–LI.

Kidder, Jerome Henry: Report upon the water supply of the Fish commission station at Wood's Holl, Massachusetts. Report, 1884 (1886), p. 215–221, illus., pl. F17–124

Ravenel, William de Chastignier: [Installation of aquarium.] Report, 1895 (1896), p. 18.

U. S. Bureau of Fisheries: The Bureau of fisheries and its station at Woods Hole, Mass. 1915. 11 p., illus. [Occasional papers.] F15–77

U. S. Commissioner of Fisheries: Selection of Woods Hole. Report, 1875–1876 (1878), p. 4*.
——— Memoranda for the construction of a harbor of refuge at Woods Hole, Mass. (Circular typewritten and lithographed). 6 p. *Doc. 44 issued Apr. 28, 1882.*
——— [Appropriation by Congress.] Report, 1882 (1884), p. XLI.
——— [Purchase of land by private subscription; also donation of shore line.] Report, 1883 (1885), p. LIV.
——— [Service of Woods Hole laboratory.] Report, 1916 (1917), p. 45–46.

BRIEF MENTION OF WORK.

U. S. Commissioner of Fisheries: Report, 1885 (1887), p. 11; 1887 (1891), p. 16; 1896 (1898), p. 3; 1898 (1899), p. XVI; 1901 (1902), p. 10; 1906 (1908), p. 15; 1908 (1910), p. 11; 1909 (1911), p. 16; 1910 (1911), p. 19; 1911 (1913), p. 23; 1912 (1914), p. 58; 1913 (1914), p. 31; 1917 (1919), p. 86; 1918 (1920), p. 28; 1919 (1921), p. 28.

RÉSUMÉ OF INVESTIGATIONS.

Evermann, Barton Warren: [Report of investigations for 1903.] Report, 1904 (1905), p. 93–98.

Rathbun, Richard: [Report of investigations for 1887 to 1895.] Report, 1888–89 (1892), p. XLI–CVII; 1889–1891 (1893), p. 151–167; 1892 (1894), p. CIX–CX; 1893 (1895), p. 36–38; 1894 (1896), p. 96–99; 1895 (1896), p. 89–92; 1896 (1898), p. 116–118.

Ryder, John Adam: Report of operations at the laboratory of the U. S. Fish commission, Woods Hole, Mass., during the summer of 1888. Report, 1888–89 (1892), p. 513–522. *Doc. 181 issued June 30, 1892.* F12–223

Smith, Hugh McCormick: [Report of investigations for 1897 to 1903.] Report, 1897 (1898), p. CXX–CXXI; 1898 (1899), p. CXLIII–CXLV; 1899 (1900), p. 122–124; 1900 (1901), p. 122–124; 1901 (1902), p. 127–130; 1902 (1904), p. 136; 1903 (1905), p. 93–98.

U. S. Commissioner of Fisheries: [Report of investigations.] Report, 1905 (1907), p. 26–27; 1907 (1909), p. 12; 1914 (1915), p. 67–68; 1915 (1917), p. 34; 1916 (1917), p. 46.

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VESSELS, DESCRIPTION OF.

ALBATROSS.

Baird, George Washington: Report on the working of the boilers and engine of the U. S. Fish commission steamer *Albatross*. Bulletin, 1884 (1884), vol. IV, p. 145–151. F18–256

——— Annual report on the electric lighting of the United States steamer *Albatross*, December 31, 1883. Bulletin, 1884 (1884), vol. IV, p. 153–158, illus. *Doc. 73 issued June 25, 1884.* F13–90

Tanner, Zera Luther: Report on the work of the United States Fish commission steamer *Fish Hawk* for the year ending December 31, 1882, and on the construction of the steamer *Albatross*. Report, 1882 (1884), 32 p. F11–270

——— Report on the construction and outfit of the United States Fish commission steamer *Albatross*. Report, 1883 (1885), p. 3–116, LV pl. *Doc. 107 issued Sept. 7, 1886.* F11–295

——— Deep-sea exploration: a general description of the steamer *Albatross*, her appliances and methods. Bulletin, 1896 (1897), vol. XVI, p. 257–428, illus., LX pl. *Doc. 330 issued June 24, 1897.* F12–112

U. S. Bureau of Fisheries: Specifications for building the new boilers, etc., for the steamer *Albatross*. 25 p. *Doc. 109 issued 1886.*

U. S. Commissioner of Fisheries: [Proposed steamer *Albatross*.] Report, 1881 (1884), p. XXIII–XXIV.

——— [Repairs to *Albatross*.] Report, 1899 (1900), p. XXVII.

BLUE LIGHT.

U. S. Commissioner of Fisheries: [Detail by Secretary of Navy of *Blue Light*.] Report, 1877 (1879), p. 2*.

CANVAS BACK.

U. S. Bureau of Fisheries: Specifications for the paddle-wheel steam seine boat *Canvas Back*, for service in the river and bay fisheries. 12 p. *Doc. 35 issued Feb. 18, 1882.* F12–234

U. S. Commissioner of Fisheries: [*Canvas Back* loaned to State of Virginia.] Report, 1893 (1895), p. 9.

FISH HAWK.

Tanner, Zera Luther: Report on the construction and work in 1880 of the Fish commission steamer *Fish Hawk*. Report, 1881 (1884), 53 p. incl. tables, XVIII pl. *Doc. 70 issued May 1, 1884.* F12–234

U. S. Commissioner of Fisheries: Specifications for building the screw-steamer *Fish Hawk*. (U. S. Lighthouse establishment.) 46 p. *Doc. 24 issued July, 1879.* F12–235

——— [Construction of the *Fish Hawk*.] Report, 1879 (1882), p. XVIII.

——— [Description of the *Fish Hawk*.] Report, 1880 (1883), p. XXVI.

GRAMPUS.

Baird, Spencer Fullerton: [Description of the *Grampus*.] Report, 1885 (1887), p. XXIV–XXXII.

Collins, Joseph William: Report on the construction and equipment of the schooner *Grampus*. Report, 1887 (1891), p. 437–490, XVIII pl. *Doc. 171 issued Aug. 24, 1891.* F11–333

Libbey, William: [Description of the *Grampus*.] Bulletin, 1889 (1891), vol. IX, p. 393–394.

SPEEDWELL.

U. S. Commissioner of Fisheries: [Detail of the *Speedwell.*] Report, 1877 (1879), p. 2*–3*.

SCIENTIFIC APPARATUS AND INSTRUMENTS.

Beardslee, Lester Anthony: Experiments upon the time of exposure required for accurate observations on the Casella-Miller deep-sea thermometer. Report, 1877 (1879), p. 887–900. F16–125

Casella, Louis P.: Treatment of the Casella-Miller thermometer. Bulletin, 1884 (1884), vol. IV, p. 415. F18–351

Kidder, Jerome H.: Report on the thermometers of the U. S. Commission of fish and fisheries. Report, 1885 (1887), p. 185–214, illus. *Doc. 116 issued Oct. 7, 1887.* F11–300

Libbey, William: [Appliances used in the work of a physical investigation of the waters off the southern coast of New England.] Bulletin, 1889 (1891), vol. IX, p. 394–398.

Rathbun, Richard: Descriptive catalogue of the collection illustrating the scientific investigation of the sea and fresh waters. (Great International fisheries exhibition. London, 1883.) 109 p. *Doc. 69 issued Apr. 19, 1884.* F12–296

Tanner, Zera Luther: [Apparatus for deep-sea research, on the U. S. Fish commission steamer *Albatross.*] Report, 1883 (1885), p. 53–102.

——— [Appliances and apparatus on the U. S. Fish commission steamer *Albatross.*] Report, 1886 (1889), p. 636–644.

——— On the appliances for collecting pelagic organisms, with special reference to those employed by the U. S. Fish commission. Bulletin, 1894 (1895), vol. XIV, p. 143–151, pl. 9–12. *Doc. 289 issued Nov. 22, 1894.* F12–176

——— [Description of Sigsbee's gravitating trap.] Bulletin, 1894 (1895), vol. XIV, p. 145–146.

——— [Description of the Chun-Peterson tow net.] Bulletin, 1894 (1895), vol. XIV, p. 146–147.

——— [Description of the Tanner intermediate tow net.] Bulletin, 1894 (1895), vol. XIV, p. 147–151.

——— Deep-sea explorations: a general description of the steamer *Albatross*, and her appliances and methods. Bulletin, 1896 (1897), vol. XVI, p. 257–428, illus., LX pl. *Doc. 330 issued June 24, 1897.* F12–112

Townsend, Charles Haskins: Description of a closing tow net for submarine use at all depths. Report, 1894 (1896), p. 279–282. *Doc. 322 issued Nov. 28, 1896.* F11–188

Verrill, Addison Emory: Description of some of the apparatus used by the United States Commission of fish and fisheries in dredging off the New England coast. Report, 1880 (1883), p. 65–74, 4 pl. F16–303

INVESTIGATIONS AND RESULTS.

Karsten, Gustav: On the scientific investigation of the Baltic Sea and the German Ocean. Report, 1878 (1880), p. 283–294. F16–162

Martens, J. B.: [First investigation of the depths of the ocean.] Bulletin, 1882 (1883), vol. II, p. 260–262.

——— [The *Challenger* scientific voyage around the world.] Bulletin, 1882 (1883), vol. II, p. 262–264.

Prussia. Kommission zur wissenschaftlichen Untersuchung der Deutschen Meere in Kiel: Popular extracts from the investigations of the commission for the scientific examination of the German seas. [By H. A. Meyer, K. Möbius, G. Karsten, V. Hensen.] Report, 1879 (1882), p. 525–548. *Doc. 40 issued Apr. 3, 1882.* F11–214

Sars, George Ossian: Report on the Norwegian deep-sea expedition of 1878. Report, 1878 (1880), p. 257–281. F16–161

ALBATROSS.

Alexander, Alvin Burton: Notes on the boats, apparatus, and fishing methods employed by the natives of the South Sea islands, and results of fishing trials by the *Albatross.* Report, 1901 (1902), p. 741–829, pl. 30–37. *Doc. 509 issued Oct. 29, 1902.* F11–31

Alexander, Alvin Burton, and H. B. Joyce: Preliminary examination of halibut grounds of the Pacific coast. With introductory notes on the halibut fishery. Report and special papers, 1911 (1913), 56 p. *Doc. 763 issued July 22, 1912.* F12–203

Collins, Joseph William: The *Albatross* work useful to fishermen. Bulletin, 1885 (1885), vol. V, p. 466.

—— Report on the discovery and investigation of the fishing-grounds made by the Fish commission steamer *Albatross* during a cruise along the Atlantic coast and in the Gulf of Mexico, with notes on the Gulf fisheries. Report, 1885 (1887), p. 217–311, X pl. *Doc. 119 issued Nov. 3, 1887.* F11–298

—— - Notes on an investigation of the great fishing banks of the western Atlantic. Bulletin, 1886 (1887), vol. VI, p. 369–381. F18–614

Drake, Franklin Jeremiah: Report upon the investigations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1895 (Abstract). Report 1895 (1896), p. 125–168, incl. tables. *Doc. 332 issued Jan. 6, 1897.* F11–195

Fewkes, Jesse Walter: Report on the Medusæ collected by the U. S. Fish commission steamer *Albatross* in the region of the Gulf Stream in 1883–84. Report, 1884 (1886), p. 927–980. *Doc. 113 issued Dec. 1, 1886.* F11–260

—— Report on the Medusæ collected by the U. S. Fish commission steamer *Albatross* in the region of the Gulf Stream, in 1885–86. Report, 1886 (1889), p. 513–536. *Doc. 129 issued May 24, 1889.* F11–256

Gilbert, Charles Henry: The ichthyological collections of the U. S. Fish commission steamer *Albatross* during the years 1890 and 1891. Report, 1893 (1895), p. 393–476, pl. 20–35. *Doc. 326 issued Dec. 8, 1896.* F16–222

—— Report on fishes obtained by the steamer *Albatross* in the vicinity of Santa Catalina Island and Monterey Bay. Report, 1898 (1899), p. 23-29, 2 pl. *Doc. 400 issued Mar. 22, 1899.* F11–112

Johnston, Edward C.: Survey of the fishing grounds on the coast of Washington and Oregon. Appendix VI, Report, 1915 (1917), 20 p., 4 charts (part fold.). *Doc. 835 issued Nov. 9, 1916.* F16–332

Jordon, David Starr: The aquatic resources of the Hawaiian Islands. *Contents.*—Pt. 1. The shore-fishes of the Hawaiian Islands, with a general account of the fish fauna, by D. S. Jordan and B. W. Evermann. Pt. 2. The deep-sea fishes, by C. H. Gilbert. The commercial fishes, by J. N. Cobb. Pt. 3. Miscellaneous papers: Birds of Laysan and the Leeward Islands, Hawaiian group, by W. K. Fisher. Notes on a porpoise of the genus Prodelphinus from the Hawaiian Islands, by F. W. True. Isopods collected at the Hawaiian Islands, by Harriet Richardson. The Brachyura and Macrura of the Hawaiian Islands, by Mary J. Rathbun. Hydroids of the Hawaiian Islands, by C. C. Nutting. Schizopods of the Hawaiian Islands, by A. E. Ortmann. Nemerteans of the Hawaiian Islands, by W. R. Coe. The starfishes of the Hawaiian Islands, by W. K Fisher. Medusæ of the Hawaiian Islands, by A. G. Mayer. Polychaetous annelids of the Hawaiian Islands, by A. L. Treadwell. General Index. (Collections made by the U. S. Fish commission's steamer *Albatross* in 1902, under the direction of David Starr Jordan and Barton Warren Evermann.) Bulletin 1903 (1905-06), vol. XXIII, 3 parts, illus., plates (partly col.) fold. map. 5–35162

Jordan, David Starr, and Edwin Chapin Starks: List of fishes dredged by the steamer *Albatross* off the coast of Japan in the summer of 1900, with descriptions of new species and a review of the Japanese Macrouridæ. Bulletin, 1902 (1904), vol. XXII, p. 577–630, illus., 8 pl. *Doc. 551 issued Aug. 13, 1904.* F12–51

Moore, Henry Frank: [The *Albatross* South Sea expedition.] Report, 1900 (1901), p. 137–161.

Moser, Jefferson F.: The salmon and salmon fisheries of Alaska. Report of the operations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1898. Bulletin, 1898 (1899), vol. XVIII, p. 1–178, illus., fold. charts, 63 pl. *Doc. 408 issued July 27, 1899.* F12–94

—— The salmon and salmon fisheries of Alaska. Report of the Alaskan salmon investigations of the U. S. Fish commission steamer *Albatross* in 1900 and 1901. Bulletin, 1901 (1902), vol. XXI, p. 173–398, 399*–401*, illus., fold. tables and charts, XLIV pls. *Doc. 510 issued Oct. 31, 1902.* F12–278

Nye, Willard: Notes taken during the cruise of the *Albatross* to the Grand Banks on June and July, 1885. Bulletin, 1885 (1885), vol. V, p. 336. F18–470

Rathbun, Richard: Summary of the fishery investigations conducted in the north Pacific Ocean and Bering Sea from July 1, 1888, to July 1, 1892, by the U. S. Fish commission steamer *Albatross*. (List of charts and other publications bearing upon the fishery investigations of the steamer *Albatross*, p. 198–201.) Bulletin, 1892 (1894), vol. XIII, p. 127–201, pl. LI–LV. *Doc. 228 issued Feb. 6, 1894.* F12–163

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and **Edward Driscoll:** Survey of the fishing grounds on the coast of Washington and Oregon in 1914. Appendix VII, Report, 1914 (1915), 30 p., pl., fold. tab., 2 fold. charts. *Doc. 817 issued June 8, 1915.* F15–86

Smith, Sidney Irving: Report on the decapod crustacea of the *Albatross* dredgings off the east coast of the United States in 1883. Report, 1882 (1884), p. 345–426, X pl. *Doc. 78 issued Aug. 15, 1884.* F11–271

——— Report on the decapod crustacea of the *Albatross* dredgings off the east coast of the United States during the summer and autumn of 1884. Report, 1885 (1887), 101 p., XX pl. *Doc. 105 issued Sept. 1, 1886.* F11–250

Tanner, Zera Luther: Explorations of the fishing grounds of Alaska, Washington Territory, and Oregon, during 1888, by the U. S. Fish commission steamer *Albatross.* Bulletin, 1888 (1890), vol. VIII, p. 1–95 incl. tables, XII pl. (partly fold.). *Doc. 135 issued 1889.* F11–292

——— The fishing grounds of Bristol Bay, Alaska: a preliminary report upon the investigations of the U. S. Fish commission steamer *Albatross,* during the summer of 1890. Bulletin, 1889 (1891), vol. IX, p. 279–288, pl. CVIII–CX (fold.). *Doc. 161 issued June 16, 1891.* F12–149

Verrill, Addison Emory: Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, and of some additions to the fauna of Vineyard Sound. Report, 1882 (1884), p. 641–669. *Doc. 83 issued Aug. 15, 1884.* F11–267

——— Results of the explorations made by the steamer *Albatross* off the northern coast of the United States in 1883. Report, 1883 (1885), p. 503–699, XLIV pl. *Doc. 99 issued Aug. 16, 1886.* F11–243

RÉSUMÉ OF WORK.

Baird, Spencer F.: [*Albatross* put in commission Nov. 11, 1882.] Report, 1882 (1884), p. XXV–XXVII.

——— [First year's work of the *Albatross.*] Report, 1883 (1885), p. XXVIII.

——— [Work of the *Albatross.*] Report, 1884 (1886), p. XVIII–XX; 1885 (1887), p. XXVI–XXVIII; 1886 (1889), p. XLV–XLVI.

McDonald, Marshall: [Work of the *Albatross.*] Report, 1887 (1891), p. LII–LIV; 1888–89 (1892), p. XI–XII; 1889–91 (1893), p. 2–4.

Rathbun, Richard: [Investigations of the *Albatross.*] Report, 1888–89 (1892), p. XLVII–LV; 1889–91 (1893), p. 97–109; 1892 (1894), p. XCII–CIII.

——— [Operations of the steamer *Albatross* on the north Pacific Ocean and Bering Sea.] Report, 1893 (1895), p. 18–19; 1894 (1896), p. 82–87; 1895 (1896), p. 75–77; 1896 (1898), p. 96–101.

Smith, Hugh M.: [Operations of the *Albatross.*] Report, 1897 (1898), p. CXVII–CXVIII.

U. S. Commissioner of Fisheries: [Investigations of the *Albatross.*] Report, 1898 (1899), p. XVIII–XXIV; 1899 (1900), p. 21–22; 1900 (1901), p. 21–22; 1901 (1902), p. 13; 1902 (1904), p. 16–17; 1903 (1905), p. 19–20; 1904 (1905), p. 17–18; 1905 (1907), p. 37; 1906 (1908), p. 19–20; 1907 (1909), p. 17; 1908 (1910), p. 11; 1910, (1911), p. 34; 1911 (1913), p. 63; 1912 (1914), p. 65; 1913 (1914), p. 30; 1914 (1915) p. 63; 1915 (1917), p. 31; 1916 (1917), p. 39; 1917 (1919), p. 102.

BACHE.

Bigelow, Henry Bryant: Explorations of the United States Coast and geodetic survey steamer *Bache* in the western Atlantic, January to March, 1914, under the direction of the United States Bureau of fisheries, Oceanography. (Bibliography: p. 60–62.) Appendix V, Report, 1915 (1917), 62 p. incl. tables, illus., fold. chart. *Doc. 833 issued May 9, 1917.* F17–189

Packard, Alpheus Spring: Preliminary report on a series of dredgings made on the U. S. Coast survey steamer *Bache,* in the Gulf of Maine, under the direction of Prof. S. F. Baird, U. S. Fish commissioner, during September, 1873. Report 1873–74 and 1874–75 (1876), p. 687–690. F16–33

FISH HAWK.

Battle, John D.: An investigation of the coast waters of South Carolina, with reference to oyster culture. Bulletin, 1890 (1892), vol. X, p. 303–330, pl. LIV–LX. *Doc. 199 issued Nov. 2, 1892.* F12–118

Bush, Katharine Jeanette: List of deep-water Mollusca dredged by the U. S. Fish commission steamer *Fish Hawk* in 1880, 1881, and 1882, with their range in depth. Report, 1883 (1885), p. 701–727. *Doc. 100 issued Aug. 16, 1886.* F11–244

Collins, Joseph William: Report of a trip of exploration in the Chesapeake Bay, made in the spring of 1882 by the steamer *Fish Hawk*. Report, 1882 (1884) p. 1035–1038. F16–312

Grave, Caswell: Investigations for the promotion of the oyster industry of North Carolina. (*Contents.*—Investigations for the promotion of the oyster industry of North Carolina, by C. Grave. Anatomy, embryology, and growth of the oyster, by H. F. Moore. Observations and experiments on the growth of oysters, by O. C. Glaser.) Report 1903 (1904), p. 247–341, XI pl., fold. map. *Doc. 556 issued Feb. 2, 1905.* F11–12

Howe, Freeland: Report of a dredging expedition off the southern coast of New England, September, 1899. Bulletin, 1899 (1901), vol. XIX, p. 237–240. *Doc. 444 issued Sept. 12, 1900.* F12–85

Lee, Leslie A.: On the work of the *Fish Hawk* and of the U. S. Fish commission during the year 1881. Report, 1881 (1884), p. LVIII–LXIII.

Moore, Henry Frank: Report on the oyster-beds of Louisiana. Report, 1898 (1899), p. 45–100, pl. 3. *Doc. 402 issued Mar. 22, 1899.* F11–114

——— Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. Report and special papers, 1911 (1913), 42 p., VI pl., fold. map. *Doc. 774 issued May 16, 1913.* F12–72

Moore, Henry Frank, and Ernest Danglade: Condition and extent of the natural oyster beds and barren bottoms of Lavaca Bay, Texas. Appendix II, Report, 1914 (1915), 45 p., V pl., fold. chart. *Doc. 809 issued Feb. 13, 1915* F15–15

Piepmeyer, L. W.: Report on the work of the U. S. Fish commission steamer *Fish Hawk*, for the year ending December 31, 1885. Report, 1885 (1887), p. 91–101. F17–142

Smith, James A.: Report of operations of the U. S. Fish commission steamer *Fish Hawk* for the year ending December 31, 1886. Report, 1886 (1889), p. 693–697.

——— Report on the shad work of the steamer *Fish Hawk* during the season of 1886. Report, 1886 (1889), p. 819–823.

Swift, Franklin: Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George Sound, Florida. Report, 1896 (1898), p. 187–221, pl. 22. *Doc. 343 issued 1897.* F11–178

Tanner, Zera Luther: A report of the work of the United States Fish commission steamer *Fish Hawk*, for the year ending December 31, 1881, Report, 1881 (1884) p. 55–85, incl. tables., illus.

——— Report of the work of the U. S. Fish commission steamer *Fish Hawk* for the year ending December 31, 1882, and on the construction of the steamer *Albatross*. Report, 1882 (1884), p. 3–34, pls. I–III. *Doc. 79 issued Aug. 15, 1884.* F11–270

——— Report of an exploring trip of the steamer *Fish Hawk*, in Chesapeake Bay in the early spring of 1882. Bulletin, 1882 (1883), vol. II, p. 133–135. F12–351

U. S. Bureau of Fisheries: Dredging stations of the U. S. Fish commission steamer *Fish Hawk*, Lieut. Z. L. Tanner commanding, for 1880, 1881, and 1882, with temperature and other observations. Arranged for publication by Richard Rathbun. Bulletin, 1882 (1883), vol. II, p. 119–131 incl. tables. F12–385

——— Report of the operations of the U. S. Fish commission steamer *Fish Hawk*, in shad hatching, during the seasons of 1885, 1886, 1887. Bulletin, 1885 (1885), vol. V, p. 395–400; 1886 (1886), vol. VI, p. 289–293; 1887 (1887), vol. VII, p. 83–89. F18–594

——— Investigations of the aquatic resources and fisheries of Porto Rico by the U. S. Fish commission steamer *Fish Hawk* in 1899. (*Contents.*—General report, by B. W. Evermann. The fisheries and fish trade of Porto Rico, by W. A. Wilcox. The fishes of Porto Rico, by B. W. Evermann and M. C. Marsh.) Bulletin, 1900 (1902), vol. XX, 350 p., 52 pl. (incl. 3 fold. maps). *Doc. 451 issued Dec. 15, 1900.* 5–4161

——— A biological survey of the waters of Woods Hole and vicinity. Part I, Sec. I.—Physiological and zoological, by Francis B. Sumner, Raymond C. Osburn, and Leon J. Cole. (Bibliography: p. 193–200.) Sec. II.—Botanical, by Bradley M. Davis. (Literature cited: p. 497.) Part II, Sec. III.—A catalogue of the marine fauna, by Francis B. Sumner, Raymond C. Osburn, and Leon J. Cole. (Bibliography for faunal catalogue: p. 782–794.) Sec. IV.—A catalogue of the marine flora, by Bradley M. Davis. (Bibliography for floral catalogue: p. 832–833.) Bulletin, 1911 (1913), vol. XXXI, 860 p. incl. charts and tables. F13–184

Verrill, Addison Emory: Physical characters of the portion of the continental border beneath the Gulf Stream, explored by the *Fish Hawk*, 1880 to 1882. Report, 1882 (1884), p. 1045–1058, V pl. *Doc. 84 issued Aug. 15, 1884.* F11–266

Wilcox, William A.: Notes on the foreign fishery trade and local fisheries of Porto Rico. Report, 1899 (1900), p. 1–34 incl. tables, illus., 6 pl. *Doc. 418 issued Oct. 4, 1899.* F11–104

Wood, William Maxwell: Report of a trip made by the *Fish Hawk* to the lower part of Chesapeake Bay, to ascertain the character of the fisheries for shad, herring, etc., in the spring of 1884. Bulletin, 1884 (1884), vol. IV, p. 199–200 F18–281

——— Report of a trip by the steamer *Fish Hawk* to the St. Mary's and St. John's rivers to hatch shad. Bulletin, 1884 (1884), vol. IV, p. 241–242. F18–297

——— Reconnaissance of the shad fisheries of Winyaw Bay and its tributaries, by the steamer *Fish Hawk.* Bulletin, 1884 (1884), vol. IV, p. 242–243. F18–298

——— Report of operations at St. Jerome station in laying out oyster ponds by the steamer *Fish Hawk.* Report, 1883 (1885), p. 1153–1156, tables. F17–42

——— Report on the work of the U. S. Fish commission steamer *Fish Hawk*, for two years ending December 31, 1884. Report, 1884 (1886), p. 117–122.

RÉSUMÉ OF WORK.

Baird, Spencer F.: [Work of the *Fish Hawk.*] Report, 1881 (1884), p. XI–XLII; 1882 (1884), p. XXVII–XXVIII; 1883 (1885), p. XXXI–XXXIII; 1884 (1886), p. XX; 1885 (1887), p. XXVIII; 1886 (1889), p. XLVI.

McDonald, Marshall: [Work of the *Fish Hawk.*] Report, 1887 (1891), p. LIV; 1888–89 (1892), p. XII–XIII; 1889–91 (1893), p. 4–5.

Rathbun, Richard: [Investigation of the *Fish Hawk* during 1889 and 1890.] Report, 1889–92 (1893), p. 110–115.

——— [Work of the *Fish Hawk.*] Report, 1892 (1894), p. CIII–CVI; 1893 (1895), p. 22–23; 1894 (1896), p. 91–92; 1896 (1898), p. 105–109.

U. S. Commissioner of Fisheries: [Work of the *Fish Hawk.*] Report, 1898 (1899), p. XXIV; 1899 (1900), p. XXV–XXVII; 1900 (1901), p. 22; 1901 (1902), p. 13–14; 1902 (1904), p. 17; 1903 (1905), p. 20–21; 1904 (1905), p. 18; 1905 (1907), p. 37; 1906 (1908), p. 20; 1907 (1909), p. 18; 1908 (1910), p. 11; 1909 (1911), p. 17; 1911 (1913), p. 63; 1912 (1914), p. 65–66; 1914 (1915), p. 63; 1915 (1917), p. 31; 1916 (1917), p. 40; 1917 (1919), p. 102.

GRAMPUS.

Adams, A. C., and William Converse Kendall: Report upon an investigation of the fishing grounds off the coast of Florida. Bulletin, 1889 (1891), vol. IX, p. 289–312, II, illus., pl. CXI (fold.). *Doc. 162 issued July 24, 1891.* F12–150

Baird, Spencer F.: [*Grampus* goes into commission June 5, 1886.] Report, 1886 (1889), p. XIX–XX.

Collins, D. E.; T. H. Bean; and Richard Rathbun: Results of investigations by the schooner *Grampus* on the southern mackerel grounds in the spring of 1887. Bulletin, 1887 (1889), vol. VII, p. 217–267. F18–674

Libbey, William: Report upon a physical investigation of the waters off the southern coast of New England, made during the summer of 1889 by the U. S. Fish commission schooner *Grampus.* Bulletin, 1889 (1891), vol. IX, p. 391–459, incl. tables, pl. CXXIV–CLVIII. *Doc. 168 issued Aug. 26, 1891.* F11–353

——— [Physical investigations by the *Grampus* during 1892.] Report, 1893 (1895), p. 32–35.

Rathbun, Richard. [Investigations of the *Grampus.*] Report, 1892 (1894), p. CVII–CVIII; 1894 (1896), p. 91–93; 1896 (1898), p. 104–105.

U. S. Bureau of Fisheries: Report upon the operations of the U. S. Fish commission schooner *Grampus*, from June 5, 1886 to June, 30, 1888. Report, 1886 (1889), p. 701–720; 1887 (1891), p. 491–598, XVI pl. *Doc. 172 issued Aug. 24, 1891.* F11–334

RÉSUMÉ OF WORK.

U. S. Commissioner of Fisheries: [Work of the *Grampus.*] Report, 1887 (1891), p. LIV–LV; 1889–91 (1893), p. 5–6; 1903 (1905), p. 21–22; 1905 (1907) p. 37; 1906 (1908), p. 20; 1907 (1909), p. 18; 1909 (1911), p. 24; 1910 (1911), p. 28–30; 1911 (1913), p. 63; 1912 (1914), p. 66; 1913 (1914), p. 30; 1914 (1915), p. 61–63; 1915 (1917), p. 36–37; 1916 (1917), p. 40; 1917 (1919), p. 80, 102.

LOOKOUT.

Blackford, Eugene Gilbert: Report on the oyster investigation in New York with the steamer *Lookout*. Report, 1885 (1887), p. 157–163. F17–143

——— Report of the work in an oyster investigation with the steamer *Lookout*. Bulletin, 1885 (1885), vol. V, p. 52–57. F18–378

U. S. Bureau of Fisheries: Report of the shad work of the steamer *Lookout*. Report 1882 (1884), p. 35–36; 1884 (1886), p. 123–127; 1885 (1887), p. 97–101; 1886 (1889), p. 825–827. F17–123

——— Report of shad-hatching operations by the steamer *Lookout* during the seasons of 1885, 1886, 1887. Bulletin, 1885 (1885), vol. V, p. 386–394; 1886 (1886), vol. VI, p. 295–297; 1887 (1887), vol. VII, p. 111, tables. F18–596

——— Report on the operations of the steamer *Halcyon* [formerly the *Lookout*] for the year ending December 31, 1886. Report, 1886 (1889), p. 699–700. F17–148

SPEEDWELL.

Tanner, Zera Luther: Report of operations of the United States steamer *Speedwell* in 1879, while in the service of the U. S. Fish commission. Report, 1879 (1882), p. 603–614, incl. tables. F17–9

DREDGING AND HYDROGRAPHIC RECORDS.

GENERAL.

Evermann, Barton Warren: [Hydrography of Porto Rico.] Bulletin, 1900 (1902), vol. XX, pt. 1, p. 11–15.

Hoyt, W. D.: [Physical conditions at Beaufort, N. C.] Bulletin, 1917–18, (1921), vol. XXXVI, p. 384–390.

Jacobson, H.: Tables of temperature of air and water at sundry stations of the United States Signal office, from March, 1874, to February, 1875, and from March, 1876, to February, 1877, inclusive. Report, 1875–1876 (1878), p. 851–861. F16–73

Lindenkohl, A.: Notes on the model of the Gulf of Maine constructed for the U. S. Fish commission. Bulletin, 1883 (1883), vol. III, p. 449–454. F12–403

McDonald, Marshall: [Fluctuations of water temperature in the Chesapeake region.] Report, 1883 (1885), p. 1034, pl.

Murray, John: [Recognition of marine deposits.] Bulletin, 1896 (1897), vol. XVI, p. 397–403.

Murray, John, and A. Renard: On the nomenclature, origin, and distribution of deep-sea deposits. Report, 1885 (1887), p. 759–785. F17–146

Patterson, C. P.: Temperatures in the Gulf of Mexico. Report, 1872 and 1873 (1874), p. 745–748, incl. tables. F16–67

Rathbun, Richard: Ocean temperatures of the eastern coast of the United States, with 32 charts. *In* The fisheries and fishery industries of the United States. 1887. Sec. III, p. 155–238.

Smith, Sanderson, and Richard Rathbun: List of dredging stations of the U. S. Fish commission, the U. S. Coast survey, and the British steamer *Challenger*, in North American waters from 1867–1887, together with those of the principal European government expeditions of the Atlantic and Arctic oceans. Report, 1886 (1889), p. 871–1017. *Doc. 124 issued Jan. 15, 1889.* F11–291

Tanner, Z. L.: [Density of sea water.] Bulletin, 1896 (1897), vol. XVI, p. 337–343.

U. S. Bureau of Fisheries: List of the dredging stations of the United States Fish Commission (*Bache*, *Bluelight*, *Speedwell*) from 1871 to 1879, inclusive, with temperature and other observations. Arranged for publication by Sanderson Smith and Richard Rathbun. Report, 1879 (1882), p. 559–601. *Doc. 41 issued Apr. 3, 1882.* F11–215

U. S. Lighthouse Board: Table of temperatures of Little Harbor, Woods Hole, Mass., from January, 1873, to December, 1873 (inclusive). Furnished by the Lighthouse board from observations of Capt. B. J. Edwards. Report, 1871–72 (1873), p. 828–831. F16–63

ALBATROSS.

Drake, Franklin Jeremiah: Report upon the investigations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1895 (abstract). Report, 1895 (1896), p. 125–168, incl. tables. *Doc. 332 issued Jan. 6, 1897.* F11–195

Howe, Freeland: Report of a dredging expedition off the southern coast of New England, September, 1899. Bulletin, 1899 (1900), vol. XIX, p. 237–240. *Doc. 444 issued Sept. 12, 1900.* F12–85

Moser, Jefferson F.: Report on the work of the steamer *Albatross* (abstract). Report, 1897 (1898), p. CXLVII–CLXXI.

Rathbun, Richard: Summary of the fishery investigations conducted in the north Pacific Ocean and Bering Sea from July 1, 1888, to July 1, 1892, by the U. S. Fish commission steamer *Albatross*. (List of charts and other publications bearing upon the fishery investigations of the steamer *Albatross*, p. 198–201.) Bulletin, 1892 (1894), vol. XIII, p. 127–201, pl. LI–LV. *Doc. 228 issued Feb. 6, 1894.* F12–163

Schroeder, Seaton: Hydrographic work of the *Albatross* in 1884. Bulletin, 1885 (1885), vol. V, p. 269–271. F18–432

Tanner, Zera Luther: Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending December 31, 1883. Report, 1883 (1885), p. 117–236, III pl. *Doc. 96 issued Aug. 16, 1886.* F11–303

——— Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending December 31, 1884. Report, 1884 (1886), p. 3–116, incl. tables, pl. *Doc. 110 issued Dec. 1, 1886.* F11–294

——— Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending December 31, 1885. Report, 1885 (1887), p. 3–91. *Doc. 118 issued Nov. 3, 1887.* F11–299

——— Record of hydrographic soundings and dredging stations occupied by the steamer *Albatross* in 1886. Bulletin, 1886 (1887), vol. VI, p. 277–285, incl. tables. F18–592

——— Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending December 31, 1886. Report, 1886 (1889), p. 605–692, X pl. *Doc. 130 issued 1889.* F11–257

——— Report of the movements and operations of the Fish commission steamer *Albatross* from September 15 to 20, 1887. Bulletin, 1887 (1889), vol. VII, p. 155–158, incl. tables. F18–664

——— Report on the work of the U. S. Fish commission steamer *Albatross* from January 1, 1887, to June 30, 1888. Report, 1887 (1891), p. 371–435, incl. tables, IV pl. *Doc. 170 issued Aug. 24, 1891.* F11–327

——— Report on the investigations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1889. Report, 1888–89 (1892), p. 395–512, pl. L–LII (partly fold.). *Doc. 180 issued June 25, 1892.* F12–222

——— Report upon the investigations of the U. S. Fish commission steamer *Albatross* from July 1, 1889, to June 30, 1891. Report, 1889–91 (1893), p. 207–342, incl. tables, pl. *Doc. 216 issued Oct. 26, 1893.* F14–133

——— Report upon the investigations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1892. Report, 1892 (1894), 64 p. incl. tables, pl. *Doc. 284 issued Dec. 9, 1894.* F14–58

——— Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1893. Report, 1893 (1895), p. 305–341, pl. *Doc. 310 issued Mar. 21, 1896.* F14–133

——— Report upon the operations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1894. Report, 1894 (1896), p. 197–278, incl. tables. *Doc. 321 issued Dec. 2, 1896.* F11–187

U. S. Bureau of Fisheries: Records of observations made on board the United States Fish commission steamer *Albatross* during the year ending June 30, 1896. Report, 1896 (1898), p. 357–386, incl. tables. *Doc. 355 issued Feb. 14, 1898.* F11–181

——— Dredging and other records of the United States Fish commission steamer *Albatross*, with bibliography relative to the work of the vessel. Comp. by C. H. Townsend. (Chronological bibliography relative to work of the *Albatross:* p. 501–562.) Report, 1900 (1901), p. 387–562, incl. tables, pl. I–VII (part. fold.). *Doc. 472 issued Oct. 24, 1901.* F11–45

———Records of the dredging and other collecting stations of the U. S. Fish commission steamer *Albatross* in 1901 and 1902. Report, 1902 (1904), p. 397–432, incl. tables. *Doc. 541 issued Sept. 19, 1900.* F11–6

——— Records of the dredgings and other collecting and hydrographic stations of the fisheries steamer *Albatross* in 1903. Report, 1903 (1905), p. 123–138, incl. tables. *Doc. 549 issued May 17, 1904.* F11–9

——— Dredging and hydrographic records of the U. S. fisheries steamer *Albatross* for 1904 and 1905. Report and special papers, 1905 (1907), 80 p. incl. tables. *Doc. 604 issued Dec. 1, 1906.* 6–45334

——— Dredging and hydrographic records of the U. S. fisheries steamer *Albatross* for 1906. Report and special papers, 1906 (1908), 50 p. incl. tables. *Doc. 621 issued Aug. 27, 1907.* 7–35297

U. S. Bureau of Fisheries: Dredging and hydrographic records of the U. S. fisheries steamer *Albatross* during the Philippine expedition, 1907–1910. Report and special papers, 1910 (1911), 97 p. incl. tables. *Doc. 741 issued Nov. 29, 1910.* F10–4

——— Dredging and hydrographic records of the U. S. fisheries steamer *Albatross*, 1911–1920. Appendix III, Report, 1920 (192–), 190 p. *Doc. 897 issued 1921.*

FISH HAWK.

Tanner, Zera Luther: Report on the work of the U. S. Fish commission steamer *Fish Hawk* for the year ending December 31, 1882, and on the construction of the steamer *Albatross*. Report, 1882 (1884), 32 p., III pl. F11–270

U. S. Bureau of Fisheries: Dredging stations of the U. S. Fish commission steamer *Fish Hawk*, Lieut. Z. L. Tanner commanding, for 1880, 1881, and 1882, with temperature and other observations. Arranged for publication by Richard Rathbun. Bulletin, 1882 (1883), vol. II, p. 119–131, incl. tables. F12–285

LIMNOLOGY.

Birge, E. A.: Gases dissolved in the waters of Wisconsin lakes. (With discussions by J. J. Stranahan and Oscar F. Nordqvist.) Bulletin, 1908 (1910), vol. XXVIII, p. 1273–1294, diags. *Doc. 718 issued May 5, 1910.* 11–5437

Birge, E. A., and Chancey Juday: A limnological study of the Finger Lakes of New York. Bulletin, 1912 (1913), vol. XXXII, p. 525–609, illus., fold. pl. CXI–CXVI. *Doc. 791 issued Oct. 27, 1914.* F14–107

Evermann, Barton Warren: The investigation of rivers and lakes with reference to the fish environment. Bulletin, 1893 (1894), vol. XIII, p. 69–73. *Doc. 246 issued June 9, 1894.* F12–183

——— A report upon salmon investigations in the headwaters of the Columbia River, in the State of Idaho, in 1895; together with notes upon the fishes observed in that State in 1894 and 1895. Bulletin, 1896 (1897), vol. XVI, p. 149–202, pl. 67–72 (partly fold.). *Doc. 318 issued* Nov. *17, 1896.* F11–343

Evermann, Barton Warren, and Seth Eugene Meek: A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific coast in 1896. Bulletin, 1897 (1898), vol. XVII, p. 15–84, illus, 2 pl. *Doc. 352 issued Jan.* 6, 1898. F12–241

——— [Description of Lake Chautauqua.] Report, 1901 (1902), p. 169–175.

Juday, Chancey: Notes on Lake Tahoe, its trout and trout-fishing. (Literature cited: p. 146.) Bulletin, 1906 (1907), vol. XXVI, p. 133–146. *Doc. 615 issued May 11, 1907.* F11–63

——— A study of Twin Lakes, Colorado, with special consideration of the food of the trouts. (Bibliography: p. 175–178.) Bulletin, 1906 (1907), vol. XXVI, p. 147–178, pl. III. *Doc. 616 issued May 24, 1907.* F11–64

Kendall, William Converse, and E. L. Goldsborough: Fishes of the Connecticut Lakes and neighboring waters, with notes on the plankton environment. (Physical features of the lakes; p. 4–15.) Report and special papers, 1907 (1909), 77 p., 12 pls., fold. diagr. *Doc. 633 issued July 6, 1908.* 8–35558

——— Fishes and fishing in Sunapee Lake. Report and special papers, 1912 (1914), 96 p., illus., IX pl. (part. col). *Doc. 783 issued Jan. 28, 1914.* F14–1

——— The Rangeley Lakes, Maine; with special references to the habits of the fishes, fish culture and angling. Bulletin, 1915–16 (1918), vol. XXXV, p. 487–594, illus., pl. XL–XLVI (part col.). *Doc. 861 issued May 25, 1918.* F18–682

Moore, Henry Frank: An inquiry into the feasibility of introducing useful marine animals into the waters of Great Salt Lake. Report, 1899 (1900), p. 229–250, pl. 7. *Doc. 422 issued Oct. 7, 1899.* F11–107

Pope, Thomas E. B.: Devil's Lake, North Dakota. A study of physical and biological conditions, with a view to the acclimatization of fish. Report and special papers, 1907 (1909), 22 p., 3 pl., fold. map. *Doc. 634 issued July 16, 1908.* 8–35574

Reighard, Jacob E.: Some plankton studies in the Great Lakes. Bulletin, 1893 (1894), vol. XIII, p. 127–142, pl. *Doc. 252 issued June 26, 1894.* F12–183

Smiley, Charles Wesley: List of 1817 of the principal lakes of the United States with designation of their locations. Report, 1882 (1884), p. 59–89. F16–327

Snyder, John Otterbein: Relationships of the fish fauna of the lakes of southeastern Oregon. Bulletin, 1907 (1908), vol. XXVII, p. 69–102, illus., fold. map, diagrs. *Doc. 636 issued Sept. 28, 1908.* 8–35669

PLANKTON.

Birge, Edward A., and Chancey Juday: [Plankton in Finger Lakes.] Bulletin, 1912 (1913), vol. XXXII, p. 587–597.

Doolittle, A. A.: [Notes on the plankton environment of the Connecticut Lakes: p. 65–77, chart, diagr.] *In* Kendall and Goldsborough: Fishes of the Connecticut Lakes and neighboring waters. Report and special papers, 1907 (1908), 77 p., 12 pls., fold. map., fold. diagr. *Doc. 633 issued July 6, 1908.* 8–35558

Haeckel, Ernst Heinrich Philipp August: Planktonic studies: A comparative investigation of the importance and constitution of the pelagic fauna and flora. (Literature: p. 565–641.) Report 1889–1891 (1893), p. 565–641. *Doc. 221 issued Oct. 25, 1893.* F12–231

Hensen, Victor: Organic matter in the Baltic. Bulletin, 1885 (1886), vol. V, p. 267–269. F18–431

Peck, James I.: The sources of marine food. Bulletin, 1895, (1896) vol. XV, p. 351–368, pl. 64–71. *Doc. 307 issued Apr. 11, 1897.* F12–248

Rathbun, Richard: [Plankton.] Bulletin, 1887 (1889), vol. VII, p. 259–267.

Reighard, Jacob E.: Some plankton studies in the Great Lakes. Bulletin, 1893 (1894), vol. XIII, p. 127–142, pl. *Doc. 252 issued June 26, 1894.* F12–183

——— Methods of plankton investigation in their relation to practical problems. Bulletin, 1897 (1898), vol. XVII, p. 169–175. *Doc. 365 issued Aug. 8, 1898.* F12–110

Snow, Julia W.: The plankton algae of Lake Erie, with special reference to the *Chlorophyceæ.* (Literature: p. 393.) Bulletin 1902 (1904), vol. XXII, p. 369–394, IV col. pl. *Doc. 529 issued Aug. 4, 1903.* F12–69

POTOMOLOGY.

Evermann, Barton Warren: [A reconnaissance of the streams and lakes of western Montana and northwestern Wyoming.] Bulletin, 1891 (1893), vol. XI, p. 3–40, illus., pl. I–V.

——— The investigation of rivers and lakes with reference to the fish environment. Bulletin, 1893 (1894), vol. XIII, p. 69–73. *Doc. 246 issued June 9, 1894.* F12–183

——— A preliminary report upon salmon investigations in Idaho in 1894. Bulletin, 1895 (1896), vol. XV, p. 253–284. *Doc. 301 issued Feb. 20, 1896.* F12–245

Gilbert, Charles Henry, and Barton Warren Evermann: [Report upon investigations in the Columbia River basin.] Bulletin, 1894 (1895), vol. XIV, p. 169–187, pl. 13–19.

Ingalls, J. F.: Character of the streams on the northern shore of Lake Michigan. Report, 1872–73 (1874), p. 630–632.

Jenkins, Oliver Peebles: [Temperature conditions in the Kern River region.] Bulletin, 1905 (1906), vol. XXV, p. 39–43.

Kirsch, Philip H.: Reports upon investigations in the Maumee River basin during the summer of 1893. Bulletin, 1894 (1895), vol. XIV, p. 315–337. *Doc. 295 issued May 22, 1895.* 6–10556

Milner, James W.: Character of some of the northern tributaries of Lake Michigan. Report, 1872–73 (1874), p. 632–633.

Smiley, Charles Wesley: List of the principal rivers of the United States which empty into the Atlantic Ocean, Pacific Ocean, and the Gulf of Mexico, with their tributaries. Report, 1882 (1884), p. 91–202. F16–328

——— Alphabetical index to the principal rivers of the United States. Report, 1882 (1884), p. 1059–1086. F16–326

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GENERAL.

U. S. Bureau of Fisheries: Report upon the inquiry respecting food-fishes and the fishing grounds. Report, 1888–89 (1892), p. 41–46; 1889–91 (1893), p. 97–171, 1892 (1894), p. 88–110; 1893 (1895), p. 17–51; 1894 (1896), p. 81–114; 1895 (1896), p. 73–92; 1896 (1898), p. 93–118 (by Richard Rathbun); 1898 (1899), p. 123–146; 1899 (1900), p. 119–146; 1900 (1901), p. 119–135; 1901 (1902), p. 111–140; 1902 (1904), p. 111–142; 1903 (1905), p. 75–100 (by H. M. Smith); 1904 (1905), p. 81–120 (by B. W. Evermann):

——— Progress in biological inquiries. Report of the division of scientific inquiry for the fiscal year 1920 (by R. E. Coker). Appendix II, Report, 1920 (192–), 32 p. *Doc. 896 issued Dec. 16, 1920.*

ANATOMY (INCLUDING HISTOLOGY, MORPHOLOGY, AND OSTEOLOGY).

Greene, C. W.: Anatomy and histology of the alimentary tract of the king salmon. Bulletin, 1912 (1913), vol. XXXII, p. 73–100, pl. XXV–XXVIII. *Doc. 777 issued July 25, 1913.* F15–20

——— The skeletal musculature of the king salmon. Bulletin, 1913 (1914), vol. XXXIII, p. 21–59, illus. *Doc. 796 issued Aug. 8, 1914.* F14–113

Hermes, Otto: On the mature male sexual organs of the conger eel (*Conger vulgaris*), with some observations on the male of the common eel (*Anquilla vulgaris*, Flemming). Bulletin, 1881 (1882), vol. I, p. 126–130, illus. F12–316

Herrick, C. J.: The peripheral nervous system of the bony fishes. Bulletin, 1898 (1899), vol. XVIII, p. 315–320, illus. *Doc. 415 issued Oct. 21, 1899.* F12–101

Kuntz, Albert: Notes on the habits, morphology of the reproductive organs, and embryology of the viviparous fish, *Gambusia affinis*. Bulletin, 1913 (1915), vol. XXXIII, p. 177–190, pl. XVI–XIX. *Doc. 806 issued Oct. 28, 1914.* F14–106

——— The histological basis of adaptive shades and colors in the flounder, *Paralichthys albiguttus*. (Bibliography: p. 26–28.) Bulletin, 1915–16 (1918), vol. XXXV, 29 p., illus., 2 col. pl. *Doc. 842 issued May 28, 1917.* F17–185

Lucas, Frederic Augustus: The osteology and immediate relations of the tilefish, *Lopholatilus chamaeleonticeps*. Bulletin, 1904 (1905), vol. XXIV, p. 81–86, illus. *Doc. 559 issued Feb. 14, 1905.* F12–3

Marsh, Millard Caleb: [Note on the eye of the *Anableps dovii*.] Bulletin, 1901 (1902), vol. XXI, p. 150–151.

Parker, George Howard: Structure and functions of the ear of the squeteague. (Bibliography: p. 1222–1224.) Bulletin, 1908 (1910), vol. XXVIII, p. 1211–1224, pl. CXXII. *Doc. 715 issued May 5, 1910.* 10–35606

Ryder, J. A.: Notes on the development, spinning habits, and structure of the four-spined stickelback, *Apeltes quadracus*. Bulletin, 1881 (1882), vol. I, p. 24–29. F12–331

——— Development of the Spanish mackerel (*Cybium maculatum*). Bulletin, 1881 (1882), vol. I, p. 135–173, pl. I–IV. F12–317

——— Histological rationale of retardation.] Bulletin, 1881 (1882), vol. I, p. 187–190.

——— A contribution to the development and morphology of the Lophobranchiates: (*Hippocampus antiquorum*, the sea-horse.) Bulletin, 1881 (1882), vol. I, p. 191–199, pl. XVII. F12–320

Shufeldt, Robert Wilson: The osteology of *Amia calva*, including certain special reference to the skeleton of Teleosteans. Report, 1883 (1885), p. 747–878, XIV pl. *Doc. 90 issued Mar. 19, 1885.* F11–305

——— The skeleton of the black bass. Bulletin, 1899 (1901), vol. XIX, p. 311–320, illus., pl. 44. *Doc. 448 issued Sept. 6, 1900.* F12–283

Silvester, Charles Frederick: The blood vascular system of the tile fish. *Lopholatilus chamaeleonticeps.* (Literature: p. 112–114.) Bulletin, 1904 (1905), vol. XXIV, p. 87–114, illus., fold. col. pl. *Doc. 560 issued Feb. 14, 1905.* F12–4

Sullivan, Michael X.: The physiology of the digestive tract of elasmobranchs. (Bibliography: p. 24–27.) Bulletin, 1907 (1908), vol. XXVII, p. 1–27, pl. *Doc. 625 issued Oct. 15, 1907.* 7–35366

EMBRYOLOGY.

Baird, S. F.: [Facts concerning reproduction of fish.] Report, 1886 (1889), p. 80–85.

Cary, H. H.: Period of incubation of eggs of German carp. Bulletin, 1883 (1883), vol. III, p. 447. F18–179

Earll, R. E.: [Reproduction of the cod.] Report, 1878 (1880), p. 712–718.

——— [Reproduction of the Spanish mackerel.] Report, 1880 (1883), p. 403–406.

——— [Blackfish eggs impregnated.] Bulletin, 1885 (1885), vol. V, p. 91.

Eigenmann, C. H.: On the viviparous fishes of the Pacific coast of North America. (Contains "A review of the Embiotocidæ," by C. H. Eigenmann and A. B. Ulrey: p. 382–400. *Cymatogaster aggregatus* Gibbons: A contribution to the ontogeny of viviparous fishes, by C. H. Eigenmann: p. 401–468.) Bulletin, 1892 (1894), vol. XII, p. 381–478, pl. XCII–CXVIII. *Doc. 231 issued June 26, 1894.* F12–159

——— The egg and development of the conger eel. Bulletin, 1901 (1902), vol. XXI, p. 37–44, illus. *Doc. 476 issued Oct. 2, 1901.* F12–263

Ewart, J. Cossar: On the natural and artificial fertilization of the sea herring eggs. Bulletin, 1884 (1884), vol. IV, p. 193–197. F13–95

Gaines, Kemp: [Distinguishing the sex of carp.] Bulletin, 1885 (1885), vol. V, p. 468–469.

Goode, G. B.: [Reproduction of the swordfish.] Report, 1880 (1883), p. 330–331.

——— Notes on the life-history of the eel, chiefly derived from a study of recent European authorities. ("A list of the most important papers concerning the eel and its reproduction": p. 112–124.) Bulletin, 1881 (1882), vol. I, p. 71–124, illus. F12–335

——— [Reproduction of the mackerel.] Report, 1881 (1884), p. 111–116.

Gudger, Eugene Willis: [Embryology of the toadfish (*Opsanus tau*).] Bulletin, 1908 (1910), vol. XXVIII, p. 1095–1105, illus.

Hensen, Victor: On the occurrence and quantity of the eggs of some of the fish of the Baltic, especially those of the plaice (*Platessa platessa*), the flounder (*Platessa vulgaris*), and the cod (*Gadus morrhua*). Report, 1882 (1884), p. 427–454, illus. F16–313

Hermes, Otto: On the mature sexual organs of the conger eel (*Conger vulgaris*), with some observations on the male of the common eel (*Anquilla vulgaris* Flemming). Bulletin, 1881 (1882), vol. I, p. 126–130, illus. F12–316

Jacoby, Leopold: The eel question. Report, 1879 (1882), p. 463–483. F17–3

Kuntz, Albert: The embryology and larval development of *Bairdiella chrysura* and *Anchovia mitchilli*. Bulletin, 1913 (1915), vol. XXXIII, p. 1–19, illus. *Doc. 795 issued May 29, 1914.* F14–38

——— Notes on the habits, morphology of the reproductive organs, and embryology of the viviparous fish *Gambusia affinis*. Bulletin, 1913 (1915), vol. XXXIII, p. 177–190, pl. XVI–XIX. *Doc. 806 issued Oct. 28, 1914.* F14–106

——— Notes on the embryology and larval development of five species of teleostean fishes. Bulletin, 1914 (1916), vol. XXXIV, p. 407–429, illus. *Doc. 831 issued Aug. 3, 1916.* F16–132

Kuntz, Albert, and Lewis Radcliffe: Notes on the embryology and larval development of twelve teleostean fishes. Bulletin, 1915–16 (1918), vol. XXXV, p. 88–134, illus. *Doc. 849 issued Sept. 12, 1917.* F17–261

Levene, P. A. T.: Some chemical changes in the developing fish egg. Bulletin, 1899 (1901), vol. XIX, p. 153–155. *Doc. 438 issued Aug. 31. 1900.* F12–86

McIntosh, William Carmichael: The eggs of fishes. Bulletin, 1887 (1889), vol, VII, p. 58–62. F18–650

——— [Investigations on the development of fishes at St. Andrews Marine Laboratory, Scotland.] Bulletin, 1893 (1894), vol. XIII, p. 241–256.

Moore, Henry F.: [Spawning of the herring.] Report, 1896 (1898), p. 405–417.

Moore, John Percy: [Embryology of the mackerel.] Report, 1898 (1899), p. 4–14.

Nussbaum: A simple test to learn if fish ova are impregnated. (Tr. by John A. Ryder.) Bulletin, 1882 (1883), vol. II, p. 347–348. F12–371

Pearse, A. S., and Henrietta Achtenberg: [Reproduction of the yellow perch.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 326–328.

Reisenbichler, G. F.: The thick or thin fertilization of eggs. Report, 1879 (1882), p. 633–644. F17–11

Rutter, Cloudsley: [Vitality of the spermatozoa of the quinnat salmon.] Bulletin, 1902 (1904), vol. XXII, p. 73–81.

Ryder, John Adam: Preliminary notice of the more important scientific results obtained from a study of the embryology of fishes. Bulletin, 1881 (1882), vol. I, p. 22–23. F18–10

——— Notes on the development, spinning habits, and structure of the four-spined stickleback, *Apeltes quadracus*. Bulletin, 1881 (1882), vol. I, p. 24–29. F12–331

——— Development of the Spanish mackerel (*Cybium maculatum*). Bulletin, 1881 (1882), vol. I, p. 135–173, pl. I–IV. F12–317

——— On the retardation of the development of the ova of the shad (*Alosa sapidissima*) with observations on the egg fungus and bacteria. Bulletin, 1881 (1882), vol. I, p. 177–190. F12–319

——— A contribution to the development and morphology of the Lophobranchiates (*Hippocampus antiquorum*, the sea horse). Bulletin, 1881 (1882), vol. I, p. 191–199, pl. XVII. F12–320

Ryder, John Adam: [The periods of yelk absorption in the shad.] Bulletin, 1881 (1882), vol. I, p. 247–248.

——— The micropyle of the egg of the white perch. Bulletin, 1881 (1882), vol. I, p. 282. F18–53

——— Development of the silver gar (*Belone logirostris*), with observations on the genesis of the blood in embryo fishes, and a comparison of fish ova with those of other vertebrates. Bulletin, 1881 (1882), vol. I, p. 283–301, pl. XIX–XXI. F12–323

——— On the nuclear cleavage-figures developed during the segmentation of the germinal disc of the eggs of the salmon. ("List of papers:" p. 335.) Bulletin, 1881 (1882), vol. I, p. 335–339, pl. XVIII. F12–324

——— Additional observations on the retardation of the development of the ova of the shad. Bulletin, 1881 (1882), vol. I, p. 422–424. F12–340

——— Observations on the absorption of the yelk, the food, feeding, and development of embryo fishes, comprising some investigations conducted at the central hatchery, Armory building, Washington, D. C., in 1882. Bulletin, 1882 (1883), vol. II, p. 179–205, illus. F12–357

——— On the thread-bearing eggs of the silversides (Menidia). Bulletin, 1883 (1883), vol. III, p. 193–196, illus. F12–380

——— Preliminary notice of the development and breeding habits of the Potomac catfish, *Amiurus albidus* (Lesueur) Gill. Bulletin, 1883 (1883), vol. III, p. 225–230. F12–393.

——— Report on the abnormal appearance of some shad eggs from a fish kept in confinement at Havre de Grace, Maryland. Bulletin, 1883 (1883), vol. III, p. 440. F18–172

——— On the retardation of the development of the ova in the shad (*Alosa sapidissima*) with observations on the egg fungus and bacteria. Report, 1881 (1884), p. 795–811. F16–342

——— A contribution to the embryography of osseous fishes, with special reference to the development of the cod (*Gadus morrhua*). Report, 1882 (1884), 49 p., XII pl. *Doc. 71 issued May 17, 1884.* F11–275

——— Note on the male organs of the eel. Bulletin, 1885 (1885), vol. V, p. 1–3. F18–364

——— On the development of osseous fishes, including marine and fresh-water forms. Report, 1885 (1887), 116 p., XXX pl. *Doc. 106 issued Sept. 1, 1886.* F11–296

——— Preliminary notice of the development of the toadfish, *Batrachus tau*. Bulletin, 1886 (1887), vol. VI, p. 4–8, pl. I. F18–522

——— On the earlier stages of cleavage of the blastodisk of *Raia crinacea*. Bulletin, 1886 (1887), vol. VI, p. 8–10. F18–523

——— On the intraovarian gestation of the redfish (*Sebastes marinus*). Bulletin, 1886 (1887), vol. VI, p. 92–93. F18–546

——— [Development of the sturgeon.] Bulletin, 1888 (1890), vol. VIII, p. 257–262.

Sars, George Ossian: On the spawning and development of the cod fish. Report, 1873–4 and 1874–5 (1876), p. 213–222. F16–13

Smiley, Charles Wesley: How to distinguish the sex of carp. Bulletin, 1885 (1886), vol. V, p. 36–37. F18–373

Smith, Hugh McCormick: [Spawning of the menhaden]. Bulletin, 1895 (1896), vol. XV, p. 301–302.

Syrski: Lectures on the organs of reproduction and the fecundation of fishes and especially of eels. Report, 1873–4 and 1874–5 (1876), p. 719–734, illus. F16–34

[Vitality of spermatozoa.] Bulletin, 1895 (1896), vol. XV, p. 324.

Vrasski, Vladimir Pavlovitche: [Dry method of fecundation.] Report, 1872–3 (1874), p. 239–240.

Wallich, Claudius: A method of recording egg development for use of fish-culturists. Report, 1900 (1901), p. 185–194, pl. *Doc. 452 issued Apr. 10, 1901.* F11–71

Weddige: Castrating fish. Bulletin, 1881 (1882), vol. I, p. 59–61. F18–20

Wilson, Henry Van Peters: The embryology of the sea bass (*Serranus atrarius*). ("List of papers referred to": p. 271–272.) Bulletin, 1889 (1891), vol. IX, p. 209–277, illus., pl. LXXXVIII–CVII. *Doc. 160 issued July 7, 1891.* F12–148

——— [Egg of the *Mistichthys luzonensis*.] Bulletin, 1901 (1902), vol. XXI, p. 168–169.

Worth, Stephen G.: [Fertilization of rockfish or striped-bass eggs.] Bulletin, 1881 (1882), vol. I, p. 174–176.

FOOD.

Alger, Charles J.: [The relation of fish to sewage.] Bulletin, 1885 (1885), vol. V, p. 346.

Anderson, O. P.: [Liability of young carp to starve.] Bulletin, 1886 (1887), vol. VI, p. 402.

Atkins, Charles G.: Foods for young salmonoid fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 839–851. *Doc. 684 issued Apr., 1910.* 10-35561

——— [Materials for food for Atlantic salmon.] Report, 1897 (1898), p. 58–61.

Baird, Spencer Fullerton: [Natural food of fishes of eastern North America.] Report, 1886 (1889), p. 72–80.

Barfurth, D.: The food and mode of living of the salmon, the trout, and the shad. (Prefatory note by Theo. Gill.) Report, 1873–75 (1876), p. 735–759. F16–35

Bean, T. H.: [Food for aquarium animals.] Report, 1894 (1896), p. 184.

——— Movements of young alewives (?) (Pomolobus sp.) in Colorado River, Texas. Bulletin, 1881 (1882), vol. I, p. 69–70. F18–27

Benecke, Berthold: [Food of eels.] Bulletin, 1881 (1882), vol. I, p. 77–78.

Best food for young salmonoids and for larger salmonoids in ponds. Report, 1877 (1879), p. 779–782. F16-116

Brocchi, P.: [Food of carp.] Bulletin, 1886 (1887), vol. VI, p. 136.

Brooks, W. K.: The origin of the food of marine animals. Bulletin, 1893 (1894), vol. XIII, p. 87–92. *Doc. 248 issued June 6, 1894.* F12–183

Brumme: Great results obtained with little water. Bulletin, 1884 (1884), vol. IV, p. 329–331. F18–324

Chabot-Karlen: [Food for trout at Beaune, Saint-Remy and Nanteuil-en-Vallen.] Bulletin, 1894 (1895), vol. XIV, p. 309–311.

Chamberlain, Frederick M.: Some observations on salmon and trout in Alaska. Report and special papers, 1906 (1908), p. 3-112, V pl., fold. map., diagrs. *Doc. 627 issued Dec. 18, 1907.* 7–35437

Cheney, A. Nelson: Breeding natural food artificially for young fish artificially hatched. Bulletin, 1893 (1894), vol. XIII, p. 277–279. *Doc. 264 issued June 9, 1894.* F12–183

Clark, A. Howard: [Food of the swordfish.] Report, 1884 (1886), p. 234.

Clark, D. C.: [Abundance of food of cod.] Report, 1901 (1902), p. 207–208.

Clark, Frank Nelson: [Food of young whitefish.] Report, 1880 (1883), p. 586.

——— [The food of the brook trout.] Report, 1897 (1898), p. 92.

Cobb, John Nathan: Pacific cod fisheries. (Food: p. 9-10.) Report and species papers, 1915 (1917). *Doc. 830 issued Oct. 23, 1916.* F16-191.

Cole, Leon Jacob: [Feeding habits and food of the carp.] Report, 1904 (1905), p. 564–573.

Collins, Joseph William: [Food of the tile-fish.] Report, 1882 (1884), p. 244.

Collins, Joseph William and **D. E. Collins**: [Food of the mackerel.] Report. 1887 (1891), p. 519–520.

Connection of abundance of moss and of black flies with abundance of trout. Bulletin, 1882 (1883), vol. II, p. 103–104. F18–82

Dambeck, Carl: [Food of the Gadidae.] Report, 1877 (1879), p. 533.

Doolittle, A. A.: [The plankton environment of fishes in the Connecticut lakes: p. 65–77.] *In* Fishes of the Connecticut Lakes . . . , by Kendall and Goldsborough. Report and special papers, 1907 (1909), 77 p., pls., fold. map., fold. diagrs. *Doc. 633 issued July 6, 1908.* 8–35558

Dunn, Matthias: Food of mackerel, pilchards, and herring. Bulletin, 1885 (1885), vol. V, p. 305. F18–450

Earll, R. Edward: [Food of the cod.] Report, 1878 (1880), p. 710–711.

——— [Food of the Spanish mackerel.] Report, 1880 (1883), p. 403.

Eigenmann, Carl H.: [Food of the young squeteague.] Bulletin, 1901 (1902), vol. XXI, p. 46–47.

Evermann, Barton Warren: [Food of whitefish.] Report, 1894 (1896), p. 301.

——— [Food of the Pompano (*Trachinotus carolinus*), and of the Sheepshead (*Archosargus probatocephalus*) of Indian River, Florida.] Report, 1896 (1898), p. 232–233.

Field, Irving A.: Unutilized fishes and their relation to the fishing industries. Report and special papers, 1906 (1908), 50 p., pl. *Doc. 622 issued Sept. 10, 1907.* 7–35352

[Food of carp.] Bulletin, 1885 (1885), vol. V, p. 341.

Forbes, Stephen Alfred: The food of young whitefish (*Coregonus clupeiformis*). Bulletin, 1881 (1882), vol. I, p. 19–20. F18–8

——— On the food of the young whitefish (Coregonus). Bulletin, 1881 (1882), vol. I, p. 269–270. F20–122

——— An inquiry into the first food of young lake whitefish (*Coregonus clupeiformis*). Bulletin, 1881 (1882), vol. I, p. 402–403.

Forbes, Stephen Alfred: The first food of the common whitefish (*Coregonus clupeiformis* Mitch.). Report, 1881 (1884), p. 771–782. F16–339

——— Destruction of fish-food by bladderwort (Utricularia). Bulletin, 1884 (1884), vol. IV, p. 443. F18–360

——— A preliminary report on the aquatic invertebrate fauna of the Yellowstone national park, Wyoming, and of the Flathead region of Montana. Bulletin, 1891 (1893), vol. XI, p. 207–258, pl. XXXVII–XLII. *Doc. 210 issued Apr. 28, 1893.* F12–126

Gasch, Adolf: [Increasing the natural food in carp ponds.] Report, 1880 (1883), p. 537.

——— Pond culture. The food and spawning of carp. Report, 1883 (1885), p. 1143–1150. F17–41

Gillespie, Samuel: Growth and food of carp. Bulletin, 1882 (1883), vol. II, p. 300. F18–105

Goode, George Brown: [Food of the menhaden.] Report, 1877 (1879), p. 93–95.

——— [Food of the swordfish.] Report, 1880 (1883), p. 320–330.

——— [Food of the mackerel.] Report, 1881 (1884), p. 105–111.

——— Food of the cod. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 212–214.

Haack, Hermann: [First food of young salmonoids.] Report, 1879 (1882), p. 690–691.

Harz, C. O.: On manufactured food for trout and carp. Bulletin, 1884 (1884), vol. IV, p. 449–453. F18–121

Hawkins, J. W.: [Menhaden as a food for other fish.] Bulletin, 1881 (1882), vol. I, p. 266–268.

Henshall, James Alexander: Culture of the Montana grayling. (Feed the fry: p. 6–7.) Report and special papers, 1906 (1908), 7 p. *Doc. 628 issued Dec. 11, 1907.* 7–35451

Hildebrand, Samuel Frederick: Fishes in relation to mosquito control in ponds. Appendix IX, Report, 1918 (1920), 15 p., illus., VI pl. *Doc. 874 issued Sept. 23, 1919.* F19–38

Johnson, Robert Sidney, and M. F. Stapleton: Fish ponds on farms. (Natural and artificial fish foods: p. 19–20.) Appendix II, Report, 1915 (1917), 28 p., XIX pl. *Doc. 826 issued Dec. 15, 1915.* F16–79

Juday, Chancey: [The food of the trout of the Kern River region.] Bulletin, 1905 (1906), vol. XXV, p. 43–49.

——— [Food of the trout in Lake Tahoe.] Bulletin, 1906 (1907), vol. XXVI, p. 142–143.

——— A study of Twin Lakes, Colorado, with especial consideration of the food of the trouts. ("Bibliography": p. 175–178.) Bulletin, 1906 (1907), vol. XXVI, p. 147–178, pl. III. *Doc. 616 issued May 24, 1907.* F11–64

K., Baron von: Fish-culture as a means of improving the race of fish. Bulletin, 1885 (1885), vol. V, p. 289–291. F18–443

Kendall, William Converse: Notes on the food of four species of the cod family. Report, 1896 (1897), p. 177–186. *Doc. 340 issued May 29, 1897.* F11–177

——— [Food of the silversides.] Report, 1901 (1902), p. 247–255.

——— [Food and feeding habits of some of the commercial catfishes.] Bulletin, 1902 (1904), vol. XXII, p. 404–406.

——— American catfishes: habits, culture, and commercial importance. (Food and feeding habits: p. 12–15.) Report and special papers, 1908 (1910), 39 p., X pl. *Doc. 733 issued Aug. 23, 1910.* 10–35947

——— [Food and feeding time of trout in Rangeley Lakes.] Bulletin, 1915–16 (1918), vol. XXXV, p. 543–545.

Kerr, John W.: [Food of whitefish of Lake Erie and Lake Ontario.] Report, 1872–73 (1874), p. 80–81.

Kiel, Peter: [Food of whitefish of Lake Ontario.] Report, 1872–73 (1874), p. 82 and 84.

Kochs, W.: [Experiments with artificial propagation of minute crustaceans.] Bulletin, 1894 (1895), vol. XIV, p. 306–308.

Koss, R. A.: [Food of trout.] Bulletin, 1883 (1883), vol. III, p. 473

Lahaway: [The larvæ of mosquitoes as food for carp.] Bulletin, 1884 (1884), vol. IV, p. 310.

Lanman, Charles: [Food of the whitefish of eastern Maine and New Brunswick.] Report, 1872–73 (1874), p. 85–86.

Lee, Leslie A.: [Food of fishes off southern New England.] Report, 1881 (1884), p. lix.

Linton, Edwin: [Stomach contents of fish collected at Woods Hole.] Bulletin, 1899 (1901), vol. XIX, p. 270–284.

Linton, Edwin: [Stomach contents of the fishes of the Woods Hole region.] Bulletin, 1899 (1901), vol. XIX, p. 425–488.

——— [Notes on the food of fifty-nine species of Beaufort fishes.] Bulletin, 1904 (1905), vol. XXIV, p. 339–416.

——— [Food of the hammerhead shark and the butterfish.] Bulletin, 1906 (1907), vol. XXV, p. 127–129.

Ljungman, Axel Vilhelm: [Food of herring.] Report, 1878 (1880), p. 181–182.

——— [The food of the herring.] Report, 1879 (1882), p. 506.

McDonald, Marshall: [Artificial food for young shad.] Report, 1892 (1894), p. LXI.

Marenzeller, Emil, edler von: [The feeding of young trout and saibling.] Report, 1879 (1882), p. 657–658.

Marsh, M. C.: [Most important food of young shad.] Report, 1898 (1899), p. CXXXIX.

Marshall, William Stanley, and N. C. Gilbert: Notes on the food and parasites of some fresh-water fishes from the lakes at Madison, Wis. (Bibliography: p. 522.) Report, 1904 (1905), p. 513–522. *Doc. 591 issued Dec. 29, 1905.* F10–13

Mason, Frank Holcomb: Self-reproducing food for young fish. Bulletin, 1887 (1889), vol. VII, p. 203–206. F18–669

Mather, Fred: [Food for soles.] Bulletin, 1886 (1887), vol. VI, p. 450.

Milner, James W.: [Food of the whitefish.] Report, 1872 and 1873 (1874), p. 44–46.

Möbius, Karl August: The food of marine animals. Report, 1879 (1882), p. 485–489. F17–4

Moore, Henry Frank: [Food of herring.] Report, 1896 (1898), p. 401–403.

Mordecai, E. R.: Food of the shad of the Atlantic coast of the United States (*Alosa præstabilis* De Kay); and the functions of the pyloric cœca. Bulletin, 1881 (1882), vol. I, p. 277–282. F12–322

Mosher, Gideon: Do striped bass (*Roccus lineatus*) feed on Menhaden? Bulletin, 1883 (1883), vol. III, p. 410. F18–154

Myers, A. H.: [A shark's bill of fare.] Bulletin, 1885 (1885), vol. V, p. 347.

Needham, James G.: [Mayflies as food for fish.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 270–271.

New York Commissioner of Fisheries: [The quantity of food fish require.] *Quoted by* Wergeland. Report, 1878 (1880), p. 588–589.

Nicklas, Carl: Feeding carp with Indian corn. Bulletin, 1882 (1883), vol. II, p. 168. F18–96

——— The artificial feeding of carp. Report, 1882 (1884), p. 1009–1031. F16–324

——— On manufactured food for trout and carp. Bulletin, 1884 (1884), vol. IV, p. 453–455. F13–122

——— [Feeding carp artificially.] Report, 1884 (1886), p. 568–587.

Nye, Willard: Habits of whiting or frost-fish (*Merlucius bilinearis* Mitch.). Bulletin, 1886 (1887), vol. VI, p. 208. F18–577

Oesterbol, A.: Fish and Medusæ. Bulletin, 1885 (1885), vol. V, p. 331–332. F18–469

Page, Wm. F.: [Artificial food for fish, used at Neosho.] Report, 1892 (1894), p. LIII–LIV.

——— Feeding and rearing fishes, particularly trout, under domestication. (Bibliography: p. 312–314.) Bulletin, 1894 (1895), vol. XIV, p. 289–314. *Doc. 294 issued May 22, 1895.* 12–17377

——— [The natural food of the black basses, crappies, and rock bass.] Report, 1897 (1898), p. 164.

Paige, Charles L.: The comparative value of foods for rainbow trout and other salmonoids. Bulletin, 1908 (1910), vol. XXVIII, p. 795–798. *Doc. 679 issued Apr. 1910.* 10–35419

Pancritius, P.: On the food and digestion of German fish. Bulletin, 1886 (1887), vol. VI, p. 145–148. F18–561

Pearse, Arthur Sperry: The food of the shore fishes of certain Wisconsin lakes. (Bibliography: p. 291–292.) Bulletin, 1915–16 (1918), vol. XXXV, p. 247–292, incl. tables, illus. *Doc. 856 issued Jan. 9, 1918.* F18–6

——— Habits of the black crappie in inland lakes of Wisconsin. (Bibliography: p. 15–16.) Appendix III, Report, 1918 (1920), 16 p. incl. cover illus. *Doc. 867 issued June 24, 1919.* F19–29

Pearse, A. S., and Henrietta Achtenberg: [Food of fishes in Wisconsin lakes.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 300–320. tables 6–22.

Peck, James I.: On the food of the menhaden. Bulletin, 1893 (1894), vol. XIII, p. 113–126, 8 pl. *Doc. 251 issued June 26, 1894.* F12–183

Peck, James I.: The sources of marine food. Bulletin, 1895 (1896), vol. XV, p. 351–368, pl. 64–71. *Doc. 307 issued Apr. 11, 1897.* F12–248

Quattlebaum, Paul: Method of catching carp with a hook. Bulletin, 1884 (1884), vol. IV, p. 380. F18–338

Radcliffe, Lewis: Fishes destructive to the eggs and larvæ of mosquitoes. (Bibliography: p. 19.) 19 p., illus. *Economic Circular 17 issued July 1, 1915.* F15–78

Rathbun, Richard: [Notice of the small surface organisms taken in the tow nets and of the contents of mackerel stomachs.] Bulletin, 1887 (1889), vol. VII, p. 259–267.

——— [Food of food-fish at Woods Hole.] Report, 1894 (1896), p. 97.

Raveret-Wattel, C.: [Daphniæ raised at] the piscicultural establishment at Gremaz (Ain), France. Bulletin, 1887 (1889), vol. VII, p. 207–211. F18–270

Reighard, Jacob E.: Some plankton studies in the Great Lakes. Bulletin, 1893 (1894), vol. XIII, p. 127–142, pl. *Doc. 252 issued June 26, 1894.* F12–183

Rutter, Cloudsley: [Food of young salmon.] Bulletin, 1902 (1904), vol. XXII, p. 110–119.

Ryder, John Adam: The Protozoa or Protophytes considered as the primary or indirect source of the food of fishes. Bulletin, 1881 (1882), vol. I, p. 236–251. F12–336

——— [The food of the shad.] Bulletin, 1881 (1882), vol. I, p. 247–251.

——— Observations on the absorption of the yelk, the food, the feeding, and development of embryo fishes, comprising some investigations conducted at the Central hatchery, Armory building, Washington, D. C., in 1882. Bulletin, 1882 (1883), vol. II, p. 179–205, illus. F12–357

——— The Protozoa and Protophytes considered as the primary or indirect source of the food of fishes. Report, 1881 (1884), p. 755–770. F16–338

——— [Sources of food of sturgeons.] Bulletin, 1888 (1890), vol. VIII, p. 262–265.

Sars, George Ossian: [Association of cod with Medusæ.] Report, 1877 (1879), p. 590–593.

Schwaab, Dr.: Live food for young fish. Bulletin, 1885 (1885), vol. V, p. 277–280. F18–437

Seagle, G. A.: [Food for the rainbow trout.] Report, 1897 (1898), p. 82–83.

Seal, William P.: Fishes in their relation to the mosquito problem. Bulletin, 1908 (1910), vol. XXVIII, p. 831–838. *Doc. 683 issued April, 1910.* 10–35562

Sekizawa, Akekio: [Food used for young fish in Japan.] Report, 1879 (1882), p. 646

Simms, George E.: [*Tubifex rivulorum* for feeding fry.] Bulletin, 1908 (1910), vol. XXVIII, p. 1022–1023.

Smith, Hugh McCormick: [Food for artificially hatched fish.] Report, 1897 (1898), p. CXXII–CXXIII.

——— [Food for carp, buffalofish, and catfish.] Report, 1901 (1902), p. 119–120.

Smith, Sidney Irving: Food of fresh-water fishes. Report, 1872–3 (1874), p. 708–709. *Doc. 7 issued 1874.* F12–216

Stearns, Silas: [Food of red snappers and pompanos.] Bulletin, 1884 (1884), vol. IV, p. 290.

Stone, Livingston: [Food of the Sacramento salmon.] Report, 1872–3 (1874), p. 190.

——— [Artificial food for salmon fry.] Report, 1897 (1898), p. 21–22.

Thatcher, James K. and Smith, Sidney I.: [Stomachs of salmon and their contents.] Report, 1872–3 (1874), p. 371.

Thorsteinson, A.: [Food of codfish.] Report, 1884 (1886), p. 322.

U. S. Bureau of Fisheries: [Natural food of young bass.] Report, 1896 (1898), p. 43.

——— [Food and enemies of the mackerel.] Report, 1897 (1898), p. 210–211; also *in* Manual of fish-culture, rev. ed., 1900, p. 212–213.

U. S. Commissioner of Fisheries: [Food of dogfishes.] Report, 1905 (1907), p. 24–25.

Verrill, A. E.: [Lists of species found in the stomachs of fishes—Food of fishes.] Report, 1871–72 (1873), p. 514–521.

Wergeland, N.: [Living organisms used for fish food.] Report, 1878 (1880), p. 573–580.

——— [Eggs and young fish as food of fishes.] Report, 1878 (1880), p. 549–550.

Widegren, Hjalmar: [Food of codfish.] Report, 1878 (1880), p. 136–137.

——— [The food of young and full-grown herring.] Report, 1877 (1879), p. 127–128.

Wilson, Charles Branch: [Larvæ of Arguli as food for surface fish.] Bulletin, 1904 (1905), vol. XXIV, p. 120–121.

——— [Odonates as food of fish.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 224–232.

Winslow, George: [The principal food of bluefish.] Report, 1871–72 (1873), p. 47.

Worth, Stephen G.: [Bass prove voracious feeders.] Report, 1893 (1895), p. 97.

——— [Food of shad.] Report, 1897 (1898), p. 136–154; also *in* Manual of fish-culture, rev. ed., 1900, p. 124.

Worth, Stephen G.: Fresh-water shrimp, a natural fish food. Bulletin, 1908 (1910), vol. XXVIII, p. 853–858. *Doc. 685 issued Apr., 1910.* 10–35418

Wozelka-Iglau, Karl: Contributions toward the improvement of the culture of the salmonoids and crawfish in smaller water-courses. Bulletin, 1895 (1896), vol. XV, p. 369–373, pl. 72. *Doc. 308 issued 1896.* F12–250

Zacharias, Otto, i. e. Emil Otto: Some of the life needs of fish. Bulletin, 1886 (1887), vol. VI, p. 445–447. F18–629

PATHOLOGY AND PATHOLOGICAL CONDITIONS.

DISEASES.

Atkins, Charles G.: [Diseased condition of salmon eggs.] Report, 1873–75, (1876), p. 488–489.

Bean, Tarleton Hoffman: [Fungus and parasites destroy salmon fry.] Report, 1894 (1896), p. 60–61.

——— [Epidemic among trout at Northville.] Report, 1894 (1896), p. 61.

Clinton, G. P.: Observations and experiments on Saprolegnia infesting fish. (Bibliography p. 171–172. Bulletin, 1893 (1894), vol. XIII, p. 163–172. *Doc. 253 issued June 26, 1894.* F12–183

Cole, Leon: [Diseases of carp.] Report, 1904 (1905), p. 579–584.

Dean, Bashford: Recent experiments in sturgeon hatching on the Delaware River. Bulletin, 1893 (1894), vol. XIII, p. 335–339, illus. *Doc. 251 issued June 26, 1894.* F12–183

Evermann, B. W.: [Disease at Cold Spring Harbor.] Report, 1904 (1905), p. 113.

Forbes, S. A.: [Fungus parasites on fish in the aquarium of the United States Fish commission at the World's Columbian exposition.] Bulletin, 1893 (1894), vol. XIII, p. 145–158.

Franke, Johann: Radical prevention of *Costia necatrix* in salmonoid fry. Bulletin, 1908 (1910), vol. XXVIII, p. 917–928. *Doc. 690 issued April, 1910.* 10–35438

Gaylord, Harvey Russell, and Millard Caleb Marsh: Carcinoma of the thyroid in the salmonoid fishes. ("Bibliography": p. 519–524.) Bulletin, 1912 (1913), vol. XXXII, p. 363–524, illus., pl. LVI–CX (part. col.). *Doc. 790 issued Apr. 22, 1914.* F14–37

Gorham, Frederic Poole: The gas-bubble disease of fish and its cause. Bulletin, 1899 (1901), vol. XIX, p. 33–37, pl. 12. *Doc. 431 issued Sept. 8, 1900.* F12–43

Green, Loren W.: On a disease affecting the rainbow trout at McCloud River station. Bulletin, 1885 (1885), vol. V, p. 472. F18–513

——— [Disease affecting rainbow trout at McCloud River station.] *Quoted by* Stone: Report, 1886 (1889), p. 738–739.

Gurley, R. R.: On the classification of the Myxosporidia, a group of protozoan parasites infesting fishes. Bulletin, 1891 (1893), vol. XI, p. 407–420. *Doc. 215 issued July 14, 1893.* F12–157

Holder, Charles Frederick: Methods of combating fungus diseases on fishes in captivity. Bulletin, 1908 (1910), vol. XXVIII, p. 933–936. *Doc. 692 issued April, 1910.* 10–35417

Klotz, J. P. J.: [Maladies and enemies of the egg.] Report, 1880 (1883), p. 505–507.

Linton, Edwin: On certain wart-like excrescences occurring on the short minnow, *Cyprinodon variegatus*, due to psorosperms. Bulletin, 1889 (1891), vol. IX, p. 99–102, pl. XXXV. *Doc. 154 issued June 11, 1891.* F12–142

Marsh, Millard Caleb: A more complete description of *Bacterium truttae*. Bulletin, 1902 (1904), vol. XXII, p. 411–415, II pl. (partly fold.). *Doc. 533 issued Sept. 11, 1903.* F12–72

Marsh, M. C., and F. P. Gorham: The gas disease in fishes. Report, 1904 (1905), p. 343–376, 3 pl. *Doc. 578 issued Aug. 28, 1905.* F10–6

Nicklas, Carl: [Sickness and death among carp.] Report, 1884 (1886), p. 564–565.

Ravenel, Wm. deC.: [Blindness among trout.] Report, 1898 (1899), p. LXVIII.

Robinson, E. M.: [Destruction of salmon fry by fungus and parasites.] Report, 1894 (1896), p. 60–61.

Rosenberg, Albert: Experience in abating disease among brook trout. Bulletin, 1908 (1910), vol. XXVIII, p. 941–945. *Doc. 694 issued April, 1910.* 10–35415

Rutter, Cloudsley: [Injuries and diseases of the quinnat salmon.] Bulletin, 1902 (1904), vol. XXII, p. 138–141.

Ryder, John Adam: On the retardation of the development of the ova of the shad (*Alosa sapidissima*), with observations on the egg-fungus and bacteria. Bulletin, 1881 (1882), vol. I, p. 177–190. F12–319

Ryder, John Adam: [Development of fungus on the ova of the shad.] Bulletin, 1881 (1882), vol. I, p. 181–184.

——— [Cause of the nondevelopment of fungus on the eggs hatched in the McDonald jar.] Bulletin, 1882 (1883), vol. II, p. 188.

——— [Experiments with carbolic acid to kill the fungus on large fishes.] Bulletin, 1882 (1883), vol. II, p. 191.

——— On the retardation of the development of ova in the shad (*Alosa sapidissima*), with observations on the egg fungus and bacteria. Report, 1881 (1884), p. 795–811. F16-342

Seagle, George A.: The artificial propagation of the rainbow trout. Bulletin, 1896 (1897), vol. VI, p. 237–256, illus., pl. 88–94. *Doc. 319 issued Nov. 14, 1896.* F12–111

Seal, William P.: Observations on the aquaria of the U. S. Fish commission at Central station, Washington, D. C. Bulletin, 1890 (1892), vol. X, p. 1–12, illus., IV pl. *Doc. 186 issued Feb. 11, 1892.* 7–1837

Sickness of the goldfish in the Royal park, Berlin. Report, 1878 (1880), p. 537–538. F16–190

Smith, Hugh M.: [Destruction of fresh-water fish by disease, in aquaria at Washington.] Report, 1897 (1898), p. CXXIII–CXXIV.

——— [Review of work by Bureau on diseases of fish.] Report, 1898 (1899), p. CXLIII; 1901 (1902), p. 124–127.

——— [Trout epidemic at Northville.] Report, 1899 (1900), p. CXLIV–CXLV.

Spencer, Leonard B.: Treatment of fungus on fishes in captivity. Bulletin, 1908 (1910), vol. XXVIII, p. 929–932. *Doc. 691 issued April, 1910.* 10–35423

Stabrowski, Xaver von: Carp culture in Germany. Bulletin, 1886 (1887), vol. VI, p. 57–59. F18–533

Stirling, A. B.: Notes on the fungus disease affecting salmon. Report, 1878 (1880), p. 525–529. F16–167

——— Additional observations on the fungus disease affecting salmon and other fish. Report, 1878 (1880), p. 531–536. F16–168

Stone, Livingston: [Fatal disease among salmon.] Report, 1881 (1884), p. 1063–1078.

Titcomb, John W.: [Diseases of fish at Nashua and Erwin.] Report, 1902 (1904), p. 34 and 48.

Tower, Ralph Winfred: Biliary calculi in the squeteague. Bulletin, 1901 (1902), vol. XXI, p. 131–135, pl. XXI. *Doc. 498 issued May 23, 1902.* F12–413

U. S. Commissioner of Fisheries: [Investigation by the Bureau of fish diseases.] Report, 1906 (1908), p. 14; 1918 (1920), p. 24–26.

Valery-Mayet: Hatching salmon eggs at Montpelier, France, and trouble with fungus. Bulletin, 1885 (1885), vol. V, p. 272. F18–434

Vincent, Eugene: Causes of disease in young salmonoids. Bulletin, 1908 (1910), vol. XXVIII, p. 907–916. *Doc. 689 issued April, 1910.* 10–35564

Walpole, Spencer, and T. H. Huxley: Diseases among the salmon of many rivers in England and Wales. Bulletin, 1881 (1882), vol. I, p. 429–448. F12–341

Zirzow, Paul: A new method of combating fungus on fishes in captivity. Bulletin, 1908 (1910), vol. XXVIII, p. 937-940. *Doc. 693 issued April, 1910.* 10–35416

MORTALITY.

Atkins, Charles G.: [Protrusion of the eye among the Penobscot salmon in 1881–82.] Report, 1881 (1884), p. 1085.

Baird, S. F.: [Mortality of fish.] Report, 1884 (1886), p. XLII–XLIII.

Bean, Tarleton: [Fish killed by thunder and struck by lightning.] Report, 1894 (1896), p. 61.

Brown, J. J.: [Sawdust injurious to fish.] Bulletin, 1885 (1885), vol. V, p. 111.

Chamberlain, T.: [Mortality among California salmon.] Report, 1901 (1902), p. 117–119.

Cheever, Henry T.: [Movements of a school of herring.] Bulletin, 1885 (1885), vol. V, p. 87–88.

Collins, J. W.: [Mortality among the tilefish.] Report, 1882 (1884), p. 253–283.

Dunning, Philo: Two hundred tons of dead fish, mostly perch, at Lake Mendota. Wisconsin, Bulletin, 1884 (1884), vol. IV, p. 439–443. F13–120

Evermann, Barton Warren: [Fish killed by slimy sponge.] Report, 1884 (1886), p. 329.

——— [Excess of nitrogen and deficiency of oxygen at Nashua.] Report, 1904 (1905), p. 109–112.

——— [Mortality among trout fry at Allentown.] Report 1904 (1905), p. 112.

——— [Menhaden mortality in Narraganset Bay.] Report, 1904 (1905), p. 113.

Forbes, S. A.: Preliminary report upon the invertebrate animals inhabiting lakes Geneva and Mendota, Wisconsin, with an account of the fish epidemic in Lake Mendota in 1884. Bulletin, 1888 (1890), vol. VIII, p. 473–494, pl. LXXII–LXXIV *Doc. 147 issued Mar. 25, 1891.* F11–328

Glennan, A. H.: Fish killed by poisonous water. Bulletin, 1886 (1887), vol. VI, p 10–11. F12–524

Goode, G. Brown: [Mortality of menhaden in Merrimac River.] Report, 1877 (1879), p. 101.

Hessel, Rudolph: [Street dust injurious to carp.] Bulletin, 1885 (1885), vol. V, p. 102.

Hubner, A.: [Harm to eggs and fry.] Bulletin, 1886 (1887), vol. VI, p. 187–190.

Johnson, R. S.: [Epidemic at Manchester.] Report, 1900 (1901), p. 72–73.

Klotz, J. P. J.: [Maladies and enemies of fish eggs.] Report, 1880 (1883), p. 505–507.

Knowles, Herbert M.: Dead fish on the coast of Rhode Island. Bulletin, 1886 (1887), vol. VI, p. 194–195. F18–571

Leslie, Charles C.: Scarcity of blackfish—Mortality of codfish. Bulletin, 1882 (1883), vol. II, p. 132. F18–90

McDonald, Marshall: Effect of waste products from Page's ammoniacal works upon young shad fry. Bulletin, 1885 (1885), vol. V, p. 313–314. F18–460

——— Report on the pollution of the Potomac River by the discharge of waste products from gas manufacture. Bulletin, 1885 (1885), vol. V, p. 125–126. F18–334

Mazyck, W. St. J.: [Dead fish along the coast of South Carolina.] Bulletin, 1886 (1887), vol. VI, p. 413.

Miller, N. B.: [Report on unprecedented destruction of fish life along the southern California coast.] Report, 1894 (1896), p. 217–218.

Narragansett Herald: [Oily water along the coast of North Carolina.] Bulletin, 1886 (1887), vol. VI, p. 194–195.

Pearson, John M.: [Fish killed by suffocation.] Bulletin, 1886 (1887), vol. VI, p. 452–453.

Pierce, H. D.: An opinion of the cause of mortality of fish in the Gulf of Mexico. Bulletin 1883 (1883), vol. III, p. 332. F18–143

——— Notes on the bluefish, mortality of Florida fishes, etc. Bulletin, 1884 (1884), vol. IV, p. 263–266. F18–307

Poisoned water in the Gulf of Mexico. Bulletin, 1882 (1883), vol. II, p. 104. F18–83

Rathbun, Richard: [Mortality of the alewife in Lake Ontario.] Report, 1893 (1895), p. 49.

——— [Mortality of salmon after spawning.] Report, 1899 (1900), p. 277–280.

Rowley: [Dead fish.] Bulletin, 1884 (1884), vol. IV, p. 361.

Smith, Hugh McCormick: [Mortality of alewives in Lake Ontario.] Bulletin, 1890 (1892), vol. X, p. 190–192.

——— [Mortality among brood cod at Woods Hole.] Report, 1898 (1899), p. CXLIV–CXLV.

Stone, Livingston: Mortality of McCloud River salmon in 1881. Bulletin, 1881 (1882), vol. I, p. 134. F18–32

——— [Mortality among trout due to mud.] Report, 1881 (1884), p. 1079–1083.

Stranahan, J. J.: [Mortality among fish eggs.] Bulletin, 1897 (1898), vol. XVII, p. 318.

Taylor, Harden Franklin: Mortality of fishes on the west coast of Florida. (Bibliography: p. 23–24.) Appendix III, Report, 1917 (1919), 24 p., IV pl. *Doc. 848 issued June 13, 1917.* F17–240

Taylor J. Manigault: [Dead fish along the coast of South Carolina.] Bulletin, 1886 (1887), vol. VI, p. 413–414.

U. S. Bureau of Fisheries: [Destruction of young bass by Dytiscidae.] Report, 1897 (1898), p. L.

Washburn, F. L.: [Death during summer season of fish in Lake Mille Lac, Minnesota.] *Quoted by* C. B. Wilson. Bulletin, 1904 (1905), vol. XXIV, p. 119.

Washington Post: [Dead fish in Shallotte River, North Carolina.] Bulletin, 1886 (1887), vol. VI, p. 140–141.

Webb, John G.: The mortality of fish in the Gulf of Mexico. Bulletin, 1886 (1887) vol. VI, p. 11–13. F18–525

Weigett, C., O. Sacre, and L. Schwab: [Poisonous effects of sewage on fish.] Bulletin, 1886 (1887), vol. VI, p. 144.

White, B. B.: [Disease affecting speckled catfish.] Bulletin, 1886 (1887), vol. VI, p. 404.

Wilcox, Joseph: Fish killed by cold along the Gulf of Mexico and coast of Florida. Bulletin, 1886 (1887), vol. VI, p. 123. F18–557

Wright, R. Ramsey: [Mortality of Coregonus in Lake of the Woods.] *Quoted by* C. B. Wilson. Bulletin, 1904 (1905), vol. XXIV, p. 119.

PARASITES.

Cole, Leon J.: [Parasites of carp.] Report, 1904 (1905), p. 579–584.

Davis, H. S.: Myxosporidia of the Beaufort region. A systematic and biologic study. (Bibliography: p. 238.) Bulletin, 1915–16 (1918), vol. XXXV, p. 201–243, illus., pl. XVI–XXIV. *Doc. 855 issued Dec. 17, 1917.* F18–2

Forbes, S. A.: [Kidney parasites cause death of fish.] Report, 1886 (1889), p. 739–740.

Goode, G. Brown: [Parasites of the Menhaden.] Report, 1877 (1879), p. 101–104.

——— [Parasites of the swordfish.] Report, 1880 (1883), p. 342–347.

Gurley, R. R.: On the classification of the Myxosporidia, a group of protozoan parasites infesting fishes. Bulletin, 1891 (1893), vol. XI, p. 407–420. *Doc. 215 issued July 14, 1893.* F12–157

——— The Myxosporidia, or Psorosperms of fishes, and the epidemics produced by them. Report, 1892 (1894), p. 65–304, incl. tables, 47 pl. *Doc. 285 issued Dec. 27, 1894.* F14–42

Hahn, Clarence Wilson: Sporozoön parasites of certain fishes in the vicinity of Woods Hole, Massachusetts. (Bibliography: p. 210–211.) Bulletin, 1913 (1915), vol. XXXIII, p. 191–214, pl. XX–XXI. *Doc. 810 issued Apr. 29, 1915.* F15–38

Kendall, William Converse: The fishes of the Yellowstone national park. (Parasites: p. 7–9.) Appendix VIII, Report, 1914 (1915), 28 p. *Doc. 818 issued July 16, 1915.* F15–79

Kerbert, C.: *Chromatophagus parasiticus*—A contribution to the natural history of parasites. Report, 1884 (1886), p. 1127–1136. F17–140

Lefevre, George, and Winterton Conway Curtis: [Experimental infection of fishes with glochidia.] Bulletin, 1908 (1910), vol. XXVIII, p. 622–626.

Linton, Edwin: Notes on Entozoa of marine fishes of New England, with descriptions of several new species. Report, 1886 (1889), p. 453–511, VI pl. *Doc. 128 issued 1889.* F11–255

——— On two species of larval Dibothria from the Yellowstone national park. Bulletin, 1889 (1891), vol. IX, p. 65–79, pl. XXIII–XXVII. *Doc. 150 issued June 5, 1891.* F12–138

——— On certain wart-like excrescences occurring on the short minnow, *Cyprinodon variegatus*, due to psorsperms. Bulletin, 1889 (1891), vol. IX, p. 99–102, pl. XXXV. *Doc. 154 issued June 11, 1891.* F12–1428

——— A contribution to the life history of *Dibothrium cordiceps*, a parasite infesting the trout of Yellowstone Lake. Bulletin, 1889 (1891), vol. IX, p. 337–358, pl. CXVII–CXIX. *Doc. 164 issued June 17, 1891.* F12–152

——— Notice of the occurrence of protozoan parasites (Psorosperms) on cyprinoid fishes in Ohio. Bulletin, 1889 (1891), vol. IX, p. 359–361, pl. CXX. *Doc. 165 issued July 7, 1891.* F12–153

——— Notes on Entozoa of marine fishes of New England, with descriptions of several new species. Part II. Report, 1887 (1891), 182 p., XV pl. *Doc. 175 issued Aug. 24, 1891.* F11–337

——— Notes on the Entozoa of marine fishes, with descriptions of new species. Part III. Report, 1888 (1892), p. 523–542, pl. LIII–LX. *Doc. 182 issued July 1, 1892.* F12–224

——— Fish Entozoa from Yellowstone national park. Report, 1889–91 (1893), p. 545–564, pl. 63–67. *Doc. 220 issued Oct. 25, 1893.* F12–230

——— Some observations concerning fish parasites. Bulletin, 1893 (1894), vol. XIII, p. 101–112. *Doc. 250 issued June 26, 1894.* F12–183

——— An economical consideration of fish parasites. (Partial list of American authorities on fish parasites, especially such as have been published by the U. S. Fish commission and the U. S. National museum: p. 199.) Bulletin, 1897 (1898), vol. XVII, p. 193–199. *Doc. 370 issued Aug. 8, 1898.* F12–110

——— Fish parasites collected at Woods Hole in 1898. Bulletin, 1899 (1901), vol. XIX, p. 267–304, pl. 33–43. *Doc. 446 issued Sept. 1, 1900.* F12–87

——— Parasites of fishes of the Woods Hole region. (List of papers referred to in text: p. 424.) Bulletin 1899 (1901), vol. XIX, p. 405–492, XXXIV pl. *Doc. 457 issued June 27, 1901.* F12–88

Linton, Edwin: Parasites of fishes of Beaufort, North Carolina. Bulletin, 1904 (1905), vol. XXIV, p. 321–428, XXXIV pl. *Doc. 583 issued Oct. 19, 1905.* F12–12

——— A cestode parasite in the flesh of the butterfish. (Other hosts of the parasite collected at Woods Hole, Beaufort, Tortugas, and Bermuda: p 122–126.) Bulletin 1906 (1907), vol. XXV, p. 111–132, pl. I–II. *Doc. 611 issued May 11, 1907.* F11–62

——— Notes on the flesh parasites of marine food fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1195–1209. *Doc. 714 issued April, 1910.* 10–35559

McDonald, Marshall: [Copepods injurious to cod eggs and fry.] Report, 1889–1891 (1893), p. 27.

Marshall, William Stanley, and N. C. Gilbert: Notes on the food and parasites of some fresh-water fishes from the lakes at Madison, Wis. (Bibliography: p. 522.) Appendix, Report, 1904 (1905), p. 513–522. *Doc. 591 issued Dec. 29, 1905.* F10–13

Milner, James W.: [Parasites of the whitefish. Parasites of the sturgeon.] Report, 1872–73 (1874), p. 64–74.

Pearse, A. S., and Henrietta Achtenberg: [Parasites of yellow perch.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 333–335.

Pratt, H. S.: Parasites of fresh-water fishes. Comprising some general considerations. 8 p., illus. *Economic Circular 43 issued Mar. 29, 1919.* F19–5

Ryder, John Adam: On a skin parasite of the cunner (*Ctenolabrus adspersus*). Bulletin, 1884 (1884), vol. IV, p. 37–42. F13–80

Smith, Hugh M.: [Destructive parasites in Central station aquaria.] Report, 1897 (1898), p. CXXIII–CXXIV.

Stiles, Charles Wardell: Report on a parasitic protozoan observed on fish in the aquarium of the U S. Fish commission at the World's Fair. (Bibliography: p. 175.) Bulletin, 1893 (1894), vol. XIII, p. 173–190. *Doc. 253 issued June 29, 1894.* F12–183

Surber, Thaddeus: Notes on the natural hosts of fresh-water mussels. Bulletin, 1912 (1913), vol. XXXII, p. 101–116, pl. XXIX–XXXI. *Doc. 778 issued June 28, 1913.* F13–218

U. S. Bureau of Fisheries: Information concerning parasitic worms in fish. (Statements by Prof. Edwin Linton and Dr. C. W. Stiles.) 3 p. *Economic Circular 21 issued Oct. 14, 1916.* F16–305

Ward, Henry Baldwin: Internal parasites of the Sebago salmon. (Bibliography. p. 1192–1194.) Bulletin, 1908 (1910), vol. XXVIII, p. 1151–1194, pl. CXXI. *Doc. 713 issued April, 1910.* 10–35558

Wilson, Charles Branch: The fish parasites of the genus Argulus found in the Woods Hole region. Bulletin, 1904 (1905), vol. XXIV, p. 115–131, illus. *Doc. 561 issued Feb. 14, 1905.* F12–5

——— Copepod parasites of fresh-water fishes and their economic relations to mussel glochidia. Bulletin, 1914 (1916), vol. XXXIV, p. 331–374, pl. LX–LXXIV. *Doc. 824 issued June 28, 1916.* F16–106

——— The economic relations, anatomy, and life history of the genus Lernaea. Bulletin, 1915–16 (1918), vol. XXXV, p. 165–198, illus., pl. VI–XV. *Doc. 854 issued Dec. 22, 1917.* F18–4

POLLUTION.

Forbes, S. A.: [Pollutions in the Wabash River from oil wells.] *Quoted by* Rathbun: Report, 1894 (1896), p. 109–112.

Kendall, William Converse: Notes on the fresh-water fishes of Washington county, Maine. Bulletin, 1894 (1895), vol. XIV, p. 43–54. *Doc. 236 issued Mar. 24, 1894.* F12–173

Landmark, Anthon, i. e. Even Anthon Thomas: Is sawdust injurious to the fisheries. Report, 1879 (1882), p. 625–632. F17–10

McDonald, Marshall: Report on the pollution of the Potomac River by the discharge of waste products from gas manufacture. Bulletin, 1885 (1885), vol. V, p. 125–126. F18–364

——— Effect of waste products from Page's ammoniacal works upon young shad fry. Bulletin, 1885 (1885), vol. V, p. 313–314. F18–460

Malmgren, A. J.: The injurious effects of rafting on the lake and river fisheries of Sweden. Bulletin, 1885 (1885), vol. V, p. 264–267. F18–430

Marsh, Millard Caleb: The effect of some industrial wastes on fishes. 1907. (Reprint from the Potomac River basin, water-supply and irrigation paper no. 192, p. 337–348.) *Doc. 619 issued Apr. 16, 1907.* F14–4

Milner, James W.: [Pollution of Great Lakes from sawdust.] Report, 1872 and 1873 (1874), p. 19.

Moore, H. F.: [Pollution by offal discharged by sardine factories.] Report, 1896 (1898), p. 425–427.

Neher: [Chemical inquiry in the waters of Long Island Sound.] *Quoted by* Rathbun. Report, 1889-91 (1893), p. 118–119.

Pitman, J. Talbot: [Impurities of the water.] Report, 1871–72 (1873), p. 201.

Rasch, Halvor Heyerdahl: Is sawdust as serious an obstacle to the ascent of salmon in our rivers as is generally maintained? Report, 1878 (1880), p. 517–518. F16–165

Rathbun, Richard: [River pollution from wood pulp.] Report, 1892 (1894), p. CXXVI–CXXVII.

——— [Pollution and refuse.] Report, 1899 (1900), p. 322–324.

Reichardt, E.: The purification of refuse water. Report, 1878 (1880), p. 519–521, illus. F16–166

——— The injurious influence on pisciculture of the retting water of flax and hemp. Report, 1880 (1883), p. 545–550. F16–296

Sars, George Ossian: [Pollution by whale and fish refuse.] Report, 1880 (1883), p. 183–186.

Shotwell, J. R.: Method of purifying the residium of gas-works before allowing it to pass off into the water. Report, 1875–76 (1878), p. 847–849, illus. F16–72

Southwick, J. M. K.: [Impurities of the water.] Report, 1871–72 (1873), p. 81–82.

Spangler, A. M.: The decrease of food-fishes in American waters and some of the causes. Bulletin, 1893 (1894), vol. XIII, p. 21–35. *Doc. 239 issued June 6, 1894.* F12–183

Swett, S. B.: Decrease of fish in Squamscot River, New Hampshire, on account of refuse matter from gas works. Bulletin, 1882 (1883), vol. II, p. 33. F12–344

Talbot, Arthur W.: [Waste matter deleterious to fish.] *Quoted by* Rathbun. Report, 1894 (1896), p. 112–114.

Tölke, C.: The pollution of public waters by refuse from factories. Report, 1879 (1882), p. 619-624. F20–145

U. S. Commissioner of Fisheries: [Effects of polluted Potomac water on fishes.] Report, 1903 (1905), p. 91–92.

——— [Pollution of waters.] Report, 1914 (1915), p. 66.

Watson, W. C.: [Pollution of Lake Champlain by sawdust.] Report, 1873–75 (1876), p. 536.

Zacharis, Otto, i. e. Emil Otto: Some of the life needs of fish. Bulletin, 1886 (1887), vol. VI, p. 445–447. F18–629

PHYSIOLOGY.

Greene, Charles Wilson: Physiological studies of the chinook salmon. Bulletin, 1904 (1905), vol. XXIV, p. 429–456, incl. tables, illus. *Doc. 584 issued Nov. 2, 1905.* F12–13

Sullivan, Michael X.: The physiology of the digestive tract of elasmobranchs. (Bibliography: p. 24–27.) Bulletin, 1907 (1908), vol. XXVII, p. 1–27, pl. *Doc. 625 issued Oct. 15, 1907.* 7–35366

Tower, Ralph Winfred: The gas in the swim-bladder of fishes . . . Bulletin, 1903 (1902), vol. XXI, p. 125–135. *Doc. 498 issued May 23, 1902.* F12–411

AGE.

Cockerell, Theodore Dru Alison: Observations on fish scales. Bulletin, 1912 (1913), vol. XXXII, p. 117–174, illus., pl. XXXII–XL. *Doc. 779 issued Oct. 25, 1913.* F13–198,

Rich, Willis H.: [Development of scales.] Bulletin, 1919–20 (192-), vol. XXXVII, p. 51–62.

Taylor, Harden Franklin: The structure and growth of the scales of the squeteague and the pigfish as indicative of life history. (Bibliography: p. 325–330.) Bulletin, 1914 (1915), vol. XXXIV, p. 285–330, illus., pl. L–LIX. *Doc. 823 issued Sept. 23, 1916.* F16–133

SENSE ORGANS.

Cole, Leon Jacob: [Special senses of the German carp.] Report, 1904 (1905), p. 553–556.

Herrick, Charles Judson: The organs and sense of taste in fishes. (Literature cited: p. 272.) Bulletin, 1902 (1904), vol. XXII, p. 237–272, illus. *Doc. 527 issued July 20, 1903.* F12–66

Parker, George Howard: Hearing and allied senses in fishes. (List of references: p. 64.) Bulletin, 1902 (1904), vol. XXII, p. 45–64, pl. 9. *Doc. 514 issued Feb. 26, 1903.* F12–58

——— The function of the lateral-line organs in fishes. (List of references: p. 204–207.) Bulletin, 1904 (1905), vol. XXIV, p. 183–207. *Doc. 563 issued Feb. 18, 1905.* F12–7

——— Structure and functions of the ear of the squeteague. (Bibliography: p. 1222–1224.) Bulletin, 1908 (1910), vol. XXVIII, p. 1211–1224, pl. CXXII. *Doc. 715 issued May 5, 1910.* 10–35606

——— Influence of the eyes, ears, and other allied sense organs on the movements of the dogfish, *Mustelus canis* (Mitchill). (List of references: p. 55–57.) Bulletin 1909 (1911), vol. XXIX, p. 43–58. *Doc. 738 issued Nov. 10, 1910.* F20–1

——— Effects of explosive sounds, such as those produced by motor boats and guns, upon fishes. Report and special papers, 1911 (1913), 9 p. *Doc. 752 issued Oct. 12, 1911.* F11–369

——— Sound as a directing influence in the movement of fishes. Bulletin, 1910 (1912), vol. XXX, p. 97–104. *Doc. 755 issued Apr. 27, 1912.* F12–78

——— The directive influence of the sense of smell in the dogfish. (Bibliography: p. 68.) Bulletin, 1913 (1915), vol. XXXIII, p. 61–68. *Doc. 798 issued Aug. 8, 1914.* F14–99

Parker, George Howard, and Ralph Edward Sheldon: The sense of smell in fishes. (Literature cited: p. 45–46.) Bulletin, 1912 (1914), vol. XXXII, p. 33–46. *Doc. 775 issued May 3, 1913.* F13–71

Ryder, John Adam: [Sense organs of the toad-fish and gurnard.] Report, 1888–89 (1892), p. 516.

METABOLISM.

GROWTH.

Bowers, Luther J.: [Growth of carp.] Bulletin, 1886 (1887), vol. VI, p. 144.

Brakeley, John H.: Rapid growth of carp due to abundance of food. Bulletin, 1887 (1889), vol. VII, p. 20.

Chamberlain, Frederick M.: Some observations on salmon and trout in Alaska. (Growth: p. 34.) Report and special papers, 1906 (1908), 112 p. *Doc. 627 issued Dec. 18, 1907.* 7–35437

Clark, A. Howard: [Growth of carp.] Bulletin, 1886 (1887), vol. VI, p. 316–317.

Cole, Leon Jacob: [Growth of the German carp.] Report, 1904 (1905), p. 535.

Crozier, William J., and Selig Hecht: Correlations of weight, length, and other body measurements in the weakfish, *Cynoscion regalis.* Bulletin, 1913 (1915), vol. XXXIII, p. 141–147, illus. *Doc. 800 issued Sept. 17, 1914.* F14–101

Eigenmann, Carl H.: [Rate of growth of the young squeteague.] Bulletin, 1901 (1902), vol. XXI, p. 47.

England, National Fish-Culture Association: [Growth of salmon and whitefish.] Bulletin, 1886 (1887), vol. VI, p. 314

Gilbert, Charles Henry: Age at maturity of the Pacific coast salmon of the genus Oncorhynchus. Bulletin, 1912 (1913), vol. XXXII, p. 1–22, pl. I–XVII. *Doc. 767 issued Mar. 20, 1913.* F13–70

Greene, Charles Wilson: The storage of fat in the muscular tissue of the king salmon and its resorption during the fast of the spawning migration. Bulletin, 1913 (1915), vol. XXXIII, p. 69–138, pl. III–XI. *Doc. 799 issued Sept. 10, 1914.* F14–100

——— The fat-absorbing function of the alimentary tract of the king salmon. Bulletin, 1913 (1915), vol. XXXIII, p. 149–175, pl. XII–XV. *Doc. 802 issued Oct. 28, 1914.* F14–104

Hessel, Rudolph: [Growth of carp.] Bulletin, 1886 (1887), vol. VI, p. 457.

[A large California salmon.] Bulletin, 1886 (1887), vol. VI, p. 459.

Miescher-Rüsch, F.: Contribution to the biology of the Rhine salmon. Report, 1880 (1883), p. 427–474. F16–292

Nicklas, Carl: [Necessary proportion of nutritive matter in the artificial feeding of carp.] Report, 1882 (1884), p. 1009–1031. F16–324

Page, William F.: Feeding and rearing fishes, particularly trout, under domestication. Bulletin, 1894 (1895), vol. XIV, p. 289–314. *Doc. 294 issued May 22, 1895.* 12–17377

Pancritius, P.: On the food and digestion of German fish. Bulletin, 1886 (1887) vol. VI, p. 145–148. F18–561

Rich, Willis H.: [Rate of growth of chinook salmon.] Bulletin, 1919-20 (19) vol. XXXVII, p. 45-51.

Seagle, George A.: [Size and growth of the rainbow trout.] Report, 1897 (1898), p. 72-73; also *in* Manual of fish-culture, rev. ed., 1900, p. 62-63.

U. S. Bureau of Fisheries: [Growth of the cod.] Report, 1897 (1898), p. 194; also *in* Manual of fish-culture, rev. ed., 1900, p. 196.

Wergeland, N.: [Growth of trout.] Report, 1878 (1880), p. 554.

VITALITY.

Blackford, E. G.: [Resuscitation of carp.] Bulletin, 1885 (1885), vol. V, p. 72.

Duke, R. T. W.: A four-pound carp lives eight hours out of water by being packed in wet moss. Bulletin, 1884 (1884), vol. IV, p. 16. F18-207

——— [Vitality of carp deprived of water.] Bulletin, 1884 (1884), vol. IV, p. 305.

Heath, Neil: Effect of cold on fishes. Bulletin, 1884 (1884), vol. IV, p. 369-371. F13-116

Jones, C. E.: [Vitality of carp.] Bulletin, 1886 (1887), vol. VI, p. 402.

Peirce, Milton P.: Resuscitation of apparently dead carp. Bulletin, 1884 (1884), vol. IV, p. 183. F18-275

[Resuscitating fish.] Bulletin, 1885 (1885), vol. V, p. 65-67.

Scudder, Charles W.: Vitality of German carp and restoration of some apparently dead. Bulletin, 1884 (1884), vol. IV, p. 179-180. F18-271

Smiley, Charles W.: Remarkable resuscitation of frozen carp. Bulletin, 1884 (1884), vol. IV, p. 183-184. F13-94

Wigg, George: On the insensibility of German carp to freezing. Bulletin, 1881 (1882), vol. I, p. 402.

WEIGHT.

Blackford, Eugene Gilbert: [Large halibut and pompano.] Bulletin, 1884 (1884) vol. IV, p. 315.

Crooker, L. B.: [A large bass.] Bulletin, 1884 (1884), vol. IV, p. 365.

Evermann, Barton Warren, and Edmund Lee Goldsborough: [Lengths and weights of black salmon, dog salmon, king salmon, coho salmon, and red salmon.] Bulletin, 1906 (1907), vol. XXVI, p. 233-238, 242, 246, 249, and 258.

Kendall, William Converse: Fishes and fishing in Sunapee Lake. (Weight of salmon: p. 30.) Report and special papers, 1912 (1914), 96 p. *Doc. 783 issued Jan. 28, 1914.* F14-1

Kidder, Jerome Henry: [Loss of weight in fishes after capture.] Bulletin, 1885 (1885), vol. V, p. 70.

[Large herring.] Bulletin, 1884 (1884), vol. IV, p. 311.

[Large salmon.] Bulletin, 1884 (1884), vol. IV, p. 339.

Lord, W. Scott: [Weight of 51 salmon.] Bulletin, 1881 (1882), vol. I, p. 274.

Stilwell, E. M.: [On the weight of brook trout (*Salmo fontinalis*.)] Bulletin, 1884 (1884), vol. IV, p. 311.

Stone, Livingston: Weights of salmon taken at McCloud River station in 1880. Bulletin, 1884 (1884), vol. IV, p. 178-179. F18-270

Sumner, Francis Bertody: [Changes of weight resulting from water density.] Bulletin, 1905 (1906), vol. XXV, p. 70-84.

POISONOUS FISHES.

Macgowan, D. J.: [Poisonous fish in China.] Bulletin, 1886 (1887), vol. VI, p. 130-131.

Swan, James G.: [Fatal injury inflicted by a starfish.] Bulletin, 1887 (1889), vol. VII, p. 33-48.

Tybring, O.: Poisonous fish. Bulletin, 1886 (1887), vol. VI, p. 148-151. F18-562

REGENERATION.

Ryder, John Adam: Note on the regeneration of the scales of the German carp. Bulletin, 1884 (1884), vol. IV, p. 345-346. F13-113

OXYGEN REQUIREMENTS.

Baird, Spencer Fullerton: [Deficient oxygen supply.] Bulletin, 1884 (1884), vol. IV, p. 379-380.

Birge, E. A.: Gases dissolved in the waters of Wisconsin Lakes. (With discussion by J. J. Stranahan and Oscar F. Nordqvist.) Bulletin, 1908 (1910), vol. XXVIII, p. 1273–1294, diagrs. *Doc. 718 issued May 5, 1910.* 11–5437

Marsh, Millard Caleb: Notes on the dissolved content of water in its effect upon fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 891–906. *Doc. 688 issued April, 1910.* 10–35560

Pearse, A. S., and Henrietta Achtenberg: [Oxygen requirements of fish.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 320–326, tables 23–24.

Simms, George E.: [Adequate supply of oxygen necessary in fish culture.] Bulletin, 1908 (1910), vol. XXVIII, p. 1018–1019.

Zacharias, Otto: Some of the life needs of fish. Bulletin, 1886 (1887), vol. VI, p. 445–447. F18–629

VARIATION.

[**Albino** fish.] Bulletin, 1881 (1882), vol. 1, p. 219.

Bean, Tarleton Hoffman: A hybrid between the lake trout and the brook trout. Bulletin, 1887 (1889), vol. VII, p. 216. F18–673

Knauthe, Karl: Two fertile cyprinoid hybrids. Bulletin, 1894 (1895), vol. XIV, p. 29–30. *Doc. 234 issued Mar. 24, 1894.* F12–180

Krause, K. E. H.: A hybrid plaice—*Platessa vulgaris*, with *Rhombus maximus*. Bulletin, 1882 (1883), vol. II, p. 341–342. F12–368

Ryder, John Adam: [Notice of an extraordinary hybrid between the shad and striped bass.] Bulletin, 1882 (1883), vol. II, p. 187.

RELATIONS.

ENEMIES.

Annin, James: Poachers or destructive visitors of fish ponds. Bulletin, 1884 (1884), vol. IV, p. 85–86. F18–232

Baird, Spencer F.: [Salamander (Menobranchus) eats eggs of whitefish.] Report, 1886 (1889), p. 64.

Beardsley, Arthur Eugene: The destruction of trout fry by hydra. Bulletin, 1902 (1904), vol. XXII, p. 155–160. *Doc. 518 issued Mar. 30, 1903.* F12–62

Benecke, Berthold: The enemies of pond culture in central Europe. Bulletin, 1886 (1887), vol. VI, p. 337–342. F18–606

Carpenter, Charles: What muskrats sometimes eat. Bulletin, 1884 (1884), vol. IV, p. 295. F18–318

Chamberlain, F. M.: Some observations on salmon and trout in Alaska. (Enemies: p. 107–109.) Report and special papers, 1906 (1908). *Doc. 627 issued Dec. 18, 1907.* 7–35437

Cole, Leon J.: [Enemies of carp.] Report, 1904 (1905), p. 579–584.

Collins, Joseph William: [Destruction of fish by sea lions.] Report, 1888 (1892), p. 125.

Dimmock, George: Belostomidæ and some other fish-destroying bugs. (Literature: p. 359.) Bulletin, 1886 (1887), vol. VI, p. 353–359, illus. F18–611

Eben-Bauditten: [Enemies of carp.] Report, 1878 (1880), p. 668–669.

Elliott, Henry W.: The destruction of carp by the muskrat (*Fiber zibethicus*.) Methods of trapping the rodent. Bulletin, 1884 (1884), vol. IV, p. 296–297. F18–319

Friedlaender, Oscar O.: [Sharks, enemy of fish.] Bulletin, 1884 (1884), vol. IV, p. 48.

Gardner, A. P.: [Belostoma (*Belostoma americanum*).] Bulletin, 1886 (1887), vol. VI, p. 456.

Goode, G. Brown: [The lamprey (Petromyzontidæ)—a parasite.] Bulletin, 1882 (1883), vol. II, p. 349–354.

——— [Enemies of the mackerel.] Report, 1881 (1884), p. 117–119.

Haack, Hermann: Trapping kingfishers, rodents, and other enemies of trout. Bulletin, 1884 (1884), vol. IV, p. 375–376. F18–336

Hessel, Rudolph: Snakes destructive to carp. Bulletin, 1884 (1884), vol. IV, p. 294–295. F18–317

——— [Marsh hens and night herons catch carp.] Bulletin, 1884 (1884), vol. IV, p. 308.

——— [A method of destroying noxious fishes.] Bulletin, 1884 (1884), vol. IV, p. 311.

——— [To destroy muskrats.] Bulletin, 1884 (1884), vol. IV, p. 470.

Holmes, John F., and Collins, Joseph William: [Herring and mackerel eaten by squid.] Bulletin, 1885 (1885), vol. V, p. 88–89.

Kendall, William Converse: [Enemies of the trout.] Bulletin, 1915–16 (1918), vol. XXXV, p. 562–563.

La Valette Saint George, Adolf Johann Hubert: The enemies of fish. Report, 1878 (1880), p. 509–516. F16–164

Martin, S. J.: [Destructiveness of squid.] Bulletin, 1885 (1885), vol. V, p. 62.

Merriam, C. Hart: The muskrat as a fish eater. Bulletin, 1884 (1884), vol. IV, p. 297–298. F13–108

Milner, James W.: [Enemies of the whitefish.] Report, 1872–73 (1874), p. 62–63.

Moore, Henry Frank: [Enemies of the herring]. Report, 1896 (1898), p. 403–405.

Moseley, H. N.: The fish-eating utricularia, or bladder-wort. Bulletin, 1884 (1884), vol. IV, p. 261, pl. II. F18–305

Murray, C. H.: Young trout destroyed by mosquitoes. Bulletin, 1885 (1885), vol. V, p. 243. F18–417

Nye, Willard: Do snakes catch and eat fish? Bulletin, 1883 (1883), vol. III, p. 196. F18–124

Pearse, A. S., and Henrietta Achtenberg: [Enemies of yellow perch.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 332–333.

Quarles, J. P.: [Water-bugs supposed to injure carp.] Bulletin, 1886 (1887), vol. VI, p. 403.

Redding, Joseph D.: [Sea-lion investigation.] Bulletin, 1885 (1885), vol. V, p. 346.

——— Cause of the decrease of salmon in the Sacramento River. Bulletin, 1887 (1889), vol. VII, p. 57–58. F18–649

Riley, Charles Valentine: Water-beetles destroying carp. Bulletin, 1885 (1885), vol. V, p. 311. F18–457

Simms, G. E.: A fish-eating plant. Bulletin, 1884 (1884), vol. IV, p. 257–259. F18–303

Smith, Hugh McCormick: [The destruction of salmon by seals.] Bulletin, 1897 (1898), vol. XVII, p. 120.

Snakes catching fish. Bulletin, 1884 (1884), vol. IV, p. 239. F18–296

Sturr, Charles H.: [How to construct muskrat traps.] Bulletin, 1885 (1885), vol. V, p. 342.

Surface, H. A.: The lampreys of central New York. Bulletin, 1897 (1898), vol. XVII, p. 209–215, illus., pl. 10–11. *Doc. 372 issued Aug. 5, 1898.* F12–110

U. S. Bureau of Fisheries: [Destruction of newly hatched salmon by larvæ of caddis and black fly.] Report, 1894 (1896), p. 58–60.

Walker, Ernest: [Destructiveness of hair seals in the salmon fishery: p. 47–51.] *In* Alaska fisheries and fur industries in 1915, by Bower and Aller. Appendix III, Report, 1915 (1917), 140 p. *Doc. 834 issued Jan. 6, 1917.* F12–388

Warner, J. S.: Catching fish in a creek in Tennessee by a water snake. Bulletin, 1884 (1884), vol. IV, p. 220. F18–290

Wright, J. W. A.: [Do tadpoles eat carp eggs?] Bulletin, 1886 (1887), vol. VI, p. 458–459.

ENVIRONMENTAL FACTORS.

Bettoni, Eugenio and Vinciguerra: [Environmental factors in fish culture.] Report, 1886 (1889), p. 539–601.

Hamlin, A. C.: [Environmental effects] on the salmon of Maine. Report, 1872–73 (1874), p. 338–356. F15–103

Marsh, Millard Caleb: Notes on the dissolved content of water in its effect upon fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 891–906. *Doc. 688 issued April, 1910.* 10–35560

Page, William F.: Effect of sunlight upon shad eggs. Bulletin, 1885 (1885), vol. V, p. 308. F18–453

TEMPERATURE.

Bettoni, Eugenio and Vincignerra: [Temperature of the water favorable to hatching.] Report, 1886 (1889), p. 541–542.

Bumpus, Hermon Cary: The reappearance of the tilefish. Bulletin, 1898 (1899), vol. XVIII, p. 321–333. *Doc. 416 issued Oct. 30, 1899.* F12–32

Cary, H. H.: Period of incubation of the eggs of German carp. Bulletin, 1883 (1883), vol. III, p. 447. F18–179

Day, Francis: The effects of an elevated temperature on fishes. Bulletin, 1885 (1885), vol. V, p. 142–144. F18–391

Heath, Neil: Effect of cold on fishes. Bulletin, 1884 (1884), vol. IV, p. 369–371. F13–116

Marsh, Millard Caleb, and Frederic P. Gorham: [Relation of gas disease in fish to temperature and pressure.] Report, 1904 (1905), p. 343–376.

Meyer, Heinrich Adolf: [Influence of temperature on the development of eggs of the spring herring.] Report, 1878 (1880), p. 629–634.

Milner, James W.: [Relation of the temperature to the propagation of the shad.] Report, 1872–73 (1874), p. 428–430.

——— [Environmental effect in the transportation of shad for long distances.] Report, 1873–74 and 1874–75 (1876), p. 363–370.

Moore, Henry Frank: [Effect of temperature upon the spawning of the herring.] Report, 1896 (1898), p. 409–411.

Rice, Henry J.: Experiments upon retarding the development of the eggs of the shad, made in 1879 at the United States shad-hatching station at Havre de Grace, Md. Report, 1881 (1884), p. 787–794. F16–341

Ryder, John Adam: On the retardation of the development of the ova of the shad (*Alosa sapidissima*), with observations of the egg fungus and bacteria. Bulletin, 1881 (1882), vol. I, p. 177–190. F12–319

——— Additional observation on the retardation of the development of the ova of the shad. Bulletin, 1881 (1882), vol. I, p. 422–424. F12–340

——— On the retardation of the development of the ova in the shad (*Alosa sapidissima*), with observations on the egg fungus and bacteria. Report, 1881 (1884), p. 795–811. F16–342

Wigg, George: On the insensibility of German carp to freezing. Bulletin, 1881 (1882), vol. I, p. 402.

Worth, Stephen G.: Observations on the spawning habits of the shad. Bulletin, 1891 (1893), vol. XI, p. 201–206. *Doc. 209 issued Mar. 11, 1893.* F12–127

DENSITY AND SALINITY.

Chamberlain, Frederick M.: Some observations on salmon and trout in Alaska. (Effect of change from fresh to salt water: p. 42–43.) Report and special papers, 1906 (1908). *Doc. 627 issued Dec. 18, 1907.* 7–35437

Coutance, H. A.: Biological action of the salts contained in sea water from the point of view of the maintenance of marine animals. Report, 1881 (1884), p. 749–754. F16–337

Hensen, Victor: [Influence of salinity on the occurrence and quantity of the eggs of some of the fish of the Baltic.] Report, 1882 (1884), p. 427–454.

Karsten, Gustav: [The specific gravity of the Baltic Sea and the German Ocean.] Report, 1878 (1880), p. 284–286.

Ravenel, William de Chastignier: [Table of temperature and densities at the St. Jerome station, Havre de Grace, Md., for the year 1886.] Report, 1886 (1889), p. 768–777.

Scott, George G.: Effects of changes in the density of water upon the blood of fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1143–1150. *Doc. 712 issued Apr. 21, 1910.* 10–35557

Sumner, Francis Bertody: The physiological effects upon fishes of changes in density and salinity of water. (List of works referred to: p. 107–108.) Bulletin, 1905 (1906), vol. XXV, p. 53–108. *Doc. 596 issued May 22, 1906.* F11–67

HABITS AND BEHAVIOR.

MISCELLANEOUS.

Baird, Spencer Fullerton: [Habits of alewives.] Bulletin, 1885 (1885), vol. V, p. 86–87.

Cole, Leon J.: [Habits and special senses of the carps.] Report, 1904 (1905), p. 550–579.

Gill, Theodore Nicholas: A plea for observation of the habits of fishes and against undue generalization. (With discussion by E. E. Prince, Hugh M. Smith, and Tarleton H. Bean.) Bulletin, 1908 (1910), vol. XXVIII, p. 1059–1069. *Doc. 708 issued April, 1910.* 10–35436

Goode, G. Brown: [Pugnacity of the swordfish.] Report, 1880 (1883), p. 331–342.

Hamilton, W. R.: Croaking of the perch. Bulletin, 1887 (1889), vol. VII, p. 63. F18–651

Hildebrand, Samuel Frederick: Fishes in relation to mosquito control in ponds. Appendix IX, Report, 1918 (1920), 15 p., illus., VI pl. *Doc. 874 issued Sept. 23, 1919.* F19–38

Holder, Charles Frederick: A method of studying the life history of fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1137–1141. *Doc. 711 issued April, 1910.* 10–35553

Johnson, George A.: [Biting habits of the black cross-toothed fish (*Chiasmodus niger*).] Bulletin, 1885 (1885), vol. V, p. 96.

Kendall, William Converse: [Schooling of fishes.] Bulletin, 1907 (1908), vol. XXVII, p. 281–282.

Nye, Willard: [Flying fish.] Bulletin, 1885 (1885), vol. V, p. 189–190.

Oesterbol, A.: Fish and Medusæ. Bulletin, 1885 (1885), vol. V, p. 331–332. F18–469

Pearse, Arthur Sperry: Habits of the black crappie in inland lakes of Wisconsin. (Bibliography: p. 15–16.) Appendix III, Report, 1918 (1920), 16 p., illus. *Doc. 867 issued June 24, 1919.* F19–29

Pearse, A. S., and Henrietta Achtenberg: Habits of yellow perch in Wisconsin lakes (Bibliography: p. 363–366.) Bulletin, 1917–1918 (1921), vol. XXXVI, p. 293–366, illus., pl. LXXXIII. *Doc. 885 issued Aug. 4, 1920.* F20–158

Phillips, Barnet: [Jumping of Spanish mackerel (*Cybium maculatum*).] Bulletin, 1885 (1885), vol. V, p. 74.

Rutter, Cloudsley: [Two hermaphrodite salmon.] Bulletin, 1902 (1904), vol. XXII, p. 132.

U. S. Commissioner of Fisheries: [Habits of the Gourami.] Report, 1880 (1883), p. XXXV–XXXVI.

BREEDING HABITS.

Atkins, Charles G.: Ten questions concerning the habits and breeding of land-locked salmon, with replies. Bulletin, 1884 (1884), vol. IV, p. 383–384. F18–341

Baird, Spencer Fullerton: [General notes on habits of the eel.] Bulletin, 1881 (1882), vol. I, p. 74–75.

Bean, Barton A.: [Notes on Williamson's whitefish in breeding colors.] Bulletin, 1894 (1895), vol. XIV, p. 205, pl. 21.

Benecke: [Breeding habits of the brook lamprey, *P. planeri*.] Bulletin, 1882 (1883), vol. II, p. 351–352.

Boake, Bancroft: [Gestation in Ceylon fishes.] *Quoted by* Evermann and Goldsborough. Bulletin, 1901 (1902), vol. XXI, p. 142–143.

Brice, J. J.: [Breeding habits of the salmon.] Report, 1893 (1895), p. 389–390.

Buch, Sophus Andreas: Spawning of spring herring near Norway. Bulletin, 1885 (1885), vol. V, p. 297–300. F18–447

Day, Francis: [Breeding habits of fishes of India.] Report, 1883 (1884), p. 389–392.

——— [Curious breeding habits of the Arius.] *Quoted by* Evermann and Goldsborough. Bulletin, 1901 (1902), vol. XXI, p. 145.

——— [Breeding habits of the brown trout.] *Quoted by* Kendall *in* Fishes and fishing in Sunapee Lake, p. 46. Report and special papers, 1912 (1914), 96 p. *Doc. 783 issued Jan. 28, 1914.* F14–1

Edwards, Vinal N.: [Ripe sculpins in Vineyard sound.] Bulletin, 1884 (1884), vol. IV, p. 314–315.

Eigenmann, Carl H.: On the viviparous fishes of the Pacific coast of North America. (Bibliography: p. 468–471. Bulletin, 1892 (1894), vol. XII, p. 381–478, pl. XCII–CXVIII. *Doc. 231 issued June 26, 1894.* F12–159

Evermann, Barton Warren, and Edmund Lee Goldsborough: [*Girardinichthys innominatus*, a viviparous fish.] Bulletin, 1901 (1902), vol. XXI, p. 149.

Finsch, Otto: [Spawning habits of the goldorfe.] Bulletin, 1881 (1882), vol. I, p. 224.

Gilchrist, F. C.: [Spawning habits of the tullebe.] *Quoted by* Evermann. Report, 1894 (1896), p. 321.

Gudger, Eugene Willis: The habits and life history of the toadfish (*Opsanus tau*). (Literature cited: p. 1107–1109.) Bulletin, 1908 (1910), vol. XXVIII, p. 1073–1109, illus., pl. CVII–CXIII. *Doc. 709 issued Apr. 30, 1910.* 10–35604

Gunther, Albert: [Breeding habits of the eel.] Bulletin, 1881 (1882), vol. I, p. 76–77.

——— [Universal modes of gestation.] *Quoted by* Evermann and Goldsborough. Bulletin, 1901 (1902), vol. XXI, p. 142–145.

Habersham, William Ney A.: Notes on the use of the male salmon hook and the run of 1883. Bulletin, 1884 (1884), vol. IV, p. 52. F18–215

Holder, Charles Frederick: [Breeding habits of the kelpfish.] Bulletin, 1908 (1910) vol. XXVIII, p. 1140–1141.

Kendall, William Converse: [Breeding habits of the silversides.] Report, 1901 (1902), p. 245–247.

——— [Breeding habits of some of the commercial catfishes.] Bulletin, 1902 (1904), vol. XXII, p. 406–408.

——— American catfishes. . . . [Breeding habits: p. 16–19.] Report and special papers, 1908 (1910), 39 p. *Doc. 733 issued Aug. 23, 1910.* 10–35547

——— Fishes and fishing in Sunapee Lake. [Habits of the chinook salmon, p. 26–27; American saibling, p. 62–65; smelt, p. 72–79.] Report and special papers, 1912 (1914), 96 p. *Doc. 783 issued Jan. 28, 1914.* F14–1

Kendall, W. C., and E. L. Goldsborough: Fishes of the Connecticut lakes. . . . [Breeding habits of the chub, p. 27–28; Redfin, p. 31; Eel, p. 37.] Report and special papers, 1907 (1909), 77 p. *Doc. 633 issued July 6, 1908.* 8–35558

Kirtland, Frederick, and W. B. Tully: [Do shad spawn in salt or brackish water?] Bulletin, 1886 (1887), vol. VI, p. 455–456.

Kuntz, Albert: Notes on the habits, morphology of the reproductive organs, and embryology of the viviparous fish, *Gambusia affinis.* Bulletin, 1913 (1915), vol. XXXIII, p. 177–190, pl. XVI–XIX. *Doc. 806 issued Oct. 28, 1914.* F14–106

Lydell, Dwight: The habits and culture of the black bass. Bulletin, 1902 (1904), vol. XXII, p. 39–44, pl. 8. *Doc. 513 issued Feb. 26, 1903.* F12–57

Milner, James W.: [Habits of brook trout during the breeding season.] Report, 1872–73 (1874), p. 52–55.

——— [Spawning habits of the whitefish.] Report, 1872–3 (1874), p. 48–55.

[Mode of life, habits, and propagation of the black bass and catfish.] Bulletin, 1886 (1887), vol. VI, p. 197–199.

Mowart, Thomas: [Spawning habits of the salmon.] *Quoted by* Rathbun. Report, 1899 (1900), p. 278–279.

Norny, E. R.: [Spawning habits of the striped bass.] Bulletin, 1881 (1882), vol. I, p. 67.

Pavesi, P.: Observations on male eels. Bulletin, 1886 (1887), vol. VI, p. 222–224. F18–583

Rathbun, Richard: [Observations of Vinal N. Edwards on the spawning of the menhaden.] Report, 1892 (1894), p. CX.

Reighard, Jacob Ellsworth: Methods of studying the habits of fishes, with an account of the breeding habits of the horned dace. (Literature cited: p. 1135–1136.) Bulletin, 1908 (1910), vol. XXVIII, p. 1111–1136, illus., pl. CXIV–CXX. *Doc. 710 issued May 5, 1910.* 10–35605

Rutter, Cloudsley: Natural history of the quinnat salmon. A report on investigations in the Sacramento River, 1896–1901. Bulletin, 1902 (1904), vol. XXII, p. 65–141, incl. tables, illus., pl. 10–18 (partly fold.). *Doc. 515 issued Mar. 30, 1903.* F12–59

Ryder, John Adam: Notes on the development, spinning habits, and structure of the four-spined stickleback, *Apeltes quadracus.* Bulletin, 1881 (1882), vol. I, p. 24–29. F12–331

——— [The mackerel a nocturnal spawner.] Bulletin, 1881 (1882), vol. I, p. 135–136.

——— [Spawning habits of the sea-horse.] Bulletin, 1881 (1882), vol. I, p. 191.

——— Preliminary notice of the development and breeding habits of the Potomac catfish, *Amiurus albidus* (Lesueur) Gill. Bulletin, 1883 (1883), vol. III, p. 225–230. F12–393

——— [Spinning habits of the male stickleback during breeding.] Report, 1885 (1887), p. 514–516.

——— On the intraovarian gestation of the redfish. Bulletin, 1886 (1887), vol. VI, p. 92–93. F18–546

——— [Habits of the sturgeon.] Bulletin, 1888 (1890), vol. VIII, p. 265–268.

Sawyer, J. N.: The breeding habits of the eel. Bulletin, 1886 (1887), vol. VI, p. 218–219. F18–581

Seal, William P.: Observations on the aquaria of the U. S. Fish commission at Central station, Washington, D. C. Bulletin, 1890 (1893), vol. X, p. 1–13, illus., IV, pl. *Doc. 186 issued Feb. 11, 1892.* 7–1837

Sherwood, George H., and Vinal N. Edwards: [Notes on the spawning habits of fishes of the Woods Hole region.] Bulletin, 1901 (1902), vol. XXI, p. 27–31.

Smith, Hugh McCormick, and Leighton G. Harron: Breeding habits of the yellow catfish. Bulletin, 1902 (1904), vol. XXII, p. 149–154. *Doc. 517 issued Mar. 30, 1903.* F12–61

[Spawning habits of the carp.] Bulletin, 1882 (1883), vol. II, p. 3–4

Stone, Livingston: Segregation of the sexes of trout. Bulletin, 1885 (1885), vol. V, p. 448. F18-505

Surface, H. A.: [Breeding habits of the lampreys of central New York.] Bulletin, 1897 (1898), vol. XVII, p. 209-215.

Thompson, Edward H.: Notes on the breeding of eels. Bulletin, 1884 (1884), vol. IV, p. 208. F18-283

Turner, William: [Remarkable mode of gestation in an undescribed species of *Arius*.] *Quoted by* Evermann and Goldsborough. Bulletin, 1901 (1902), vol. XXI, p. 143-145.

U. S. Bureau of Fisheries: [Artificial nest placed in ponds.] Report, 1896 (1898), p. 42; 1897 (1898), p. XLIX-LI.

Worth, Stephen G.: Observations on the hatching of the yellow perch. Bulletin, 1890 (1892), vol. X, p. 331-334, pl. LXI. *Doc. 201 issued Sept. 24, 1892.* F12-120

——— Observations on the spawning habits of the shad. Bulletin, 1891 (1893), vol. XI, p. 201-206. *Doc. 209 issued Mar. 11, 1893.* F12-127

Wyman, Jeffries: [On some unusual modes of gestation.] *Quoted by* Evermann and Goldsborough. Bulletin, 1901 (1902), vol. XXI, p. 141-142.

COLOR.

Earll, R. Edward: [Variation in color of cod.] Report, 1878 (1880), p. 709-710.

Hamlin, A. C.: [Cause of color of fish.] Report, 1872-3 (1874), p. 343-344.

Kuntz, Albert: The histological basis of adaptive shades and colors in the flounder, *Paralichthys albiguttus*. (Bibliography: p. 26-28.) Bulletin, 1915-16 (1918), vol. XXXV, 29 p., illus., 2 col. pl. *Doc. 842 issued May 28, 1917.* F17-185

Lanman, Charles: [Causes of color of brook trout.] Report, 1872-73 (1874), p. 219-220.

Lee, Leslie A.: [Color of deep-sea fish.] Report, 1881 (1884), p. LXII.

Mast, Samuel Ottmar: Changes in shade, color, and pattern in fishes, and their bearing on the problems of adaptation and behavior, with special reference to the flounders, Paralichthys and Ancylopsetta. (Bibliography: p. 230-232.) Bulletin, 1914 (1916), vol. XXXIV, p. 173-238, illus., pl. XIX-XXXVII (part col.). *Doc. 821 issued May 10, 1916.* F16-80

Wagner, Christian: [Artificial coloring of fish.] Report, 1878 (1880), p. 683-684. F16-177

HIBERNATION.

Goode, George Brown: [Hibernation of the menhaden.] Report, 1877 (1879), p. 56.

MIGRATION.

[Appearance of various kinds of fish.] Bulletin, 1885 (1885), vol. V, p. 110.

Armistead, J. J.: Atmosphere and other influences on the migration of fishes. Bulletin, 1893 (1894), vol. XIII, p. 93-99. *Doc. 248 issued June 6, 1894.* F12-183

Atkins, Charles G.: [Habits of migratory fish.] Report, 1872-3 (1874), p. 591-594.

——— [Notes on the growth and migrations of salmon.] Report, 1872-3 (1874), p. 327-335.

Baird, Spencer Fullerton: [Bluefish, a wandering fish.] Report, 1871-2 (1873), p. 236-237.

——— [Decrease of the cod fisheries of the New England coast due to the diminution of anadromous fish following the erection of river dams.] Report, 1872-3 (1874), p. XI-XIV.

——— [Migratory species of food fish.] Report, 1872-3 (1874), p. xxxviii-xl.

——— [Migrations and movements of the shad.] Report, 1872-3, (1874), p. xlviii.

——— [Migrations and movements of fishes of eastern North America.] Report, 1886 (1889), p. 47-61.

——— [Effect of temperature on the migration of fish.] Report, 1886 (1889), p. 55-57.

Barin, L. T.: Salmon in the Clackamas River. Bulletin, 1886 (1887), vol. VI, p. 111-112. F18-552

Bartlett, S. P.: [Carp in rivers.] Bulletin, 1885 (1885), vol. V, p. 101.

Blackford, Eugene Gilbert: [Codfish taken off the coast of North Carolina.] Bulletin, 1885 (1885), vol. V, p. 109.

——— [Movements of shad.] Bulletin, 1885 (1885), vol. V, p. 110-111.

——— [Salmon in the Connecticut.] Bulletin, 1885 (1885), vol. V, p. 346.

Benecke, B.: Observations on salmon in German Rivers. Bulletin, 1886 (1887), vol. VI, p. 119–122. F18–556
Boeck, Axel, i. e., Jonas Axel and A. Feddersen: [Migration of the Norwegian herring.] Report, 1873–5 (1876), p. 100–102. F16–7
[California trout in Delaware River.] Bulletin, 1884 (1884), vol. IV, p. 311.
Casto, L. P.: [The first menhaden.] Bulletin, 1885 (1885), vol. V, p. 110.
Chamberlain, Frederick M.: Some observations on salmon and trout in Alaska. (Methods used to determine migratory movements: p. 21. Influence of temperature on return of salmon to fresh water: p. 71–72.) Report and special papers, 1906 (1908). *Doc. 627 issued Dec. 18, 1907.* 7–35437
Cheney, A. Nelson: Salmon in the Hudson River. Bulletin, 1886 (1887), vol. VI, p. 351–352. F18–610
Cobb, John Nathan: Pacific cod fisheries. (Migration: p. 8.) Appendix IV, Report, 1915 (1917). *Doc. 830 issued Oct. 23, 1916.* F16–191.
Coker, Robert Ervin: Water-power development in relation to fishes and mussels of the Mississippi. (Problem of the migrations of river herring: p. 25–28.) Appendix VIII, Report, 1913 (1914), 28 p., VI pl. *Doc. 805 issued Nov. 11, 1914.* F14–130
Cole, Leon Jacob: [Migrations of the German carp.] Report, 1904 (1905), p. 556–560.
Collins, Joseph William: Appearance of dogfish (*Squalus acanthias*) on the New England coast in winter. Bulletin, 1882 (1883), vol. II, p. 8. F18–60
——— Notes on the movements, habits, and capture of mackerel for the season of 1882. Bulletin, 1882 (1883), vol. II, p. 273–286. F12–363
Collins, Joseph William, and D. E. Collins: [Migrations of the mackerel.] Report, 1887 (1891), p. 494–495.
Dambeck, Carl: [Temperature, saltness, amount of food, and currents, factors in geographical distribution of the Gadidae.] Report, 1877 (1879), p. 531–557.
Day, Francis: [Migration of spawning fish of India.] Report, 1883 (1885), p. 389.
[Drumfish in Bush river.] Bulletin, 1885 (1885), vol. V, p. 338.
Earll, R. Edward: [Migrations of the cod.] Report, 1878 (1880), p. 705–708.
——— [Movements of the Spanish mackerel.] Report, 1880 (1883), p. 399–400.
Fiedler: The migrations of salmon (*Salmo salar* L.) in the Baltic. Bulletin, 1885 (1885), vol. V, p. 185–188. F18–40
Foster, N. W.: [Halibut in fresh water.] Bulletin, 1885 (1885), vol. V, p. 90–91.
Golden, R. A.: [Big-eyed herring (*Elops saurus*), taken in the Potomac.] Bulletin, 1885 (1885), vol. V, p. 466.
Goode, George Brown: [Migrations of menhaden and the causes.] Report, 1877 (1879), p. 50–70. F12–236
——— [Migration of eels.] Bulletin, 1881 (1882), vol. I, p. 101–105.
——— [Movements of the swordfish.] Report, 1880 (1883), p. 319–324.
——— Studies of the movements of the mackerel schools.] Report, 1881 (1884), p. 119–138.
Gould, N. E.: Time of approach of fish to the New England coast. Bulletin, 1885 (1885), vol. V, p. 216. F18–410
Greene, Charles Wilson: The migration of salmon in the Columbia River. Bulletin, 1909 (1911), vol. XXIX, p. 129–148, pl. XXVI–XXVII. *Doc. 743 issued Mar. 15, 1911.* F11–102
Hermes, Otto: The migrations of eels. Report, 1884 (1886), p. 1123–1126. F17–139
Hind, Professor: [Studies of the movements of the mackerel schools; causes of irregular movement.] Report, 1881 (1884), p. 119–127.
Hinkelmann, Herr: The mode of life of eels. Bulletin, 1884 (1884), vol. IV, p. 389–390. F18–345
Holmes, John F.: [Appearance of fish.] Bulletin, 1885 (1885), vol. V, p. 347.
Karsten, Gustav: On the scientific investigation of the Baltic Sea and the German Ocean. [Relation of temperature and other physical factors to migrations of fish.] Report, 1878 (1880), p. 283–294. F16–162
Krueger, A. C.: [Carp in Susquehanna River.] Bulletin, 1884 (1884), vol. IV, p. 306.
Ljungman, Axel Vilhelm: [The migrations of the herring.] Report, 1873–1875 (1876), p. 147–150.
——— [Review of the mode of life and migrations of the herring and their physical and biological causes.] Report, 1878 (1880), p. 160–220.
Loeb, Jacques: On the influence of light on the periodical depth-migrations of pelagic animals. Bulletin, 1893 (1894), vol. XIII, p. 65–68. *Doc. 245 issued June 9, 1894.* F12–183

McDonald, Marshall: [Effect of temperature on migrations.] Report, 1888–89 (1892), p. XV–XVI.

Malmgren, A. J.: The migrations of the salmon (*Salmo salar* L.) in the Baltic. Bulletin, 1884 (1884), vol. IV, p. 322–328. F13–110

Marsh, M. C.: [Low temperature effects movements of shad.] Report, 1898 (1899), p. CXXXIX.

Martin, S. J.: Movements and catch of mackerel. Bulletin, 1882 (1883), vol. II, p. 89–90. F18–78

——— Movements of mackerel. Bulletin, 1883 (1883), vol. III, p. 470. F20–134

——— The movements of schools of mackerel. Bulletin, 1883 (1883), vol. III, p. 295–296. F20–134

Mather, Fred: [The alleged capture of a salmon in the Hudson.] Bulletin, 1884 (1884), vol. IV, p. 366.

Milner, James W.: [Migrations of the white-fish.] Report, 1872–3 (1874), p. 46–48.

Moore, Henry Frank: [Effects of physical phenomena on the herring of the Northeast Coast.] Report, 1896 (1898), p. 396–403.

O'Malley, Henry, and Willis H. Rich: Migration of adult sockeye salmon in Puget Sound and Fraser River. Appendix VIII, Report, 1918 (1920), 38 p. incl. tables, pl., fold. chart. *Doc. 873 issued Dec. 3, 1919.* F19–43

Pearse, A. S., and Henrietta Achtenberg: [Migrations of yellow perch.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 328–330.

Phillips, Barnet: A stray cod up the Hudson. Bulletin, 1883 (1883), vol. III, p. 416. F18–156

Prussia. Kommission zur wissenschaftlichen Untersuchung der Deutschen Meere in Kiel. [Causes of migration and schooling of herring.] Report, 1879 (1882), p. 543–545.

Rathbun, Richard: [Migration of the red-fish.] Report, 1896 (1898), p. 113–114.

Rich, Willis H.: Marked Pacific salmon. Announcement regarding fish expected to return in 1919 and subsequent years. 12 p., illus. *Economic Circular 45 issued May 10, 1919.* F19–28

——— Early history and seaward migration of chinook salmon in the Columbia and Sacramento rivers. (Bibliography: p. 71–72.) Bulletin, 1919-20 (192–), vol. XXXVII, 73 p., illus., IV pl. *Doc. 887 issued July 26, 1920.* F20–155

Rutter, Cloudsley: [Do salmon return to their native streams?] Bulletin, 1902 (1904), vol. XXII, p. 121–125.

Sampson, M. R.: [Appearance of mackerel.] Bulletin, 1885 (1885), vol. V, p. 337.

Sars, George Ossian: [Relation of temperature to movements of cod near the Loffoden Islands.] Report, 1877 (1879), p. 650–651.

Sherwood, George H., and Vinal N. Edwards: [Notes on the migration of fishes of the Woods Hole region.] Bulletin, 1901 (1902), vol. XXI, p. 27–31.

Slade, Elisha: Dates of the appearance of herring, shad, bass, tautog, scup, frostfish, fish-hawks, kingfishers, and Greenland seals in Taunton River from 1871 to 1883, inclusive. Bulletin, 1883 (1883), vol. III, p. 478. F18–201

Smith, Hugh McCormick: [Notes on movements of schools of menhaden.] Bulletin, 1895 (1896), vol. XV, p. 299–300.

Sterling, C.: [Carp in Lake Erie.] Bulletin, 1884 (1884), vol. IV, p. 396.

Stevenson, Charles Hugh: [Migration of the shad.] Report, 1898 (1899), p. 106–110.

Stone, Livingston: [Migration and movements of the Sacramento salmon.] Report, 1872–3 (1874), p. 186–189.

——— [Migrations and movements of the quinnat salmon.] Report, 1876 (1878), p. 803–807.

Surface, H. A.: [Habits of the lampreys of central New York.] Bulletin, 1897 (1898), vol. XVII, p. 209–215.

Tanner, Zera Luther: Movements of mackerel. Bulletin, 1883 (1883), vol. III, p. 471. F18–196

Vail, David A.: [Appearance of fish at Atlanticville, N. Y.] Bulletin, 1885 (1885), vol. V, p. 337.

Wergeland, N.: [Migrations of the fish of the Norwegian lakes.] Report, 1878 (1880), p. 539–604.

MARKING FISH.

Atkins, Charles G.: [Marking salmon for future identification.] Report, 1873–1875 (1876), p. 490–491.

——— [Marking salmon.] Report, 1886 (1889), p. 751–752.

Chamberlain, Frederick M., and Ward T. Bower: [Marked salmon: p. 29–31.] *In* Fishery and fur industries of Alaska in 1912, by B. W. Evermann. Report and special papers, 1912 (1914). *Doc. 780 issued Nov. 6, 1913.* F12–388

Evermann, Barton Warren, and F. M. Chamberlain: Alaska fisheries and fur industries in 1911. (Marking salmon: p. 15.) Report and special papers, 1911 (1913). *Doc. 766 issued Dec. 16, 1912.* F12–388

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Salmon marking experiments: p. 27–29.) Report and special papers, 1907 (1909). *Doc. 632 issued April 16, 1908.*

——— The fisheries of Alaska in 1908. (Salmon marking experiments: p. 57–59.) Report and special papers, 1908 (1910). *Doc. 645 issued Apr. 17, 1909.*

——— The fisheries of Alaska in 1909. (Marked salmon: p. 26–27.) Report and special papers, 1909 (1911). *Doc. 730 issued Mar. 20, 1912.* 7–35263

——— The fisheries of Alaska in 1910. (Return of marked salmon: p. 26–27.) Report and special papers, 1910 (1911). *Doc. 746 issued Apr. 19, 1911.*

Smith, Hugh McCormick: [Cod-tagging experiments.] Report, 1898 (1899), p. CXLI.

——— [Cod-tagging experiments.] Report, 1899 (1900), p. CXLV.

——— Notes on the tagging of four thousand adult cod at Woods Hole, Massachusetts. Report, 1901 (1902), p. 193–208. *Doc. 491 issued Apr. 22, 1902.* F11–20

PREDACIOUS BEHAVIOR.

Anderson, John: [Salmon eat herring.] Bulletin, 1883 (1883), vol. III, p. 429–430. F18–162

Baird, Spencer F.: [Bluefish most destructive to other fish.] Report, 1871–72 (1873), p. 240–246.

——— [Squeteague destructive.] Report, 1871-72 (1873), p. 243.

Campbell, J. B.: [Dolly Varden trout very destructive to all kinds of fish.] Bulletin, 1881 (1882), vol. I, p. 46.

Collins, J. W.: Note on the destruction of mackerel by dogfish. Bulletin, 1884 (1884), vol. IV, p. 248. F18–300

Dunn, Horace D.: Salmon not injured by catfish. Bulletin, 1887 (1889), vol. VII, p. 56. F18–648

Earle, R. Edward: [Dogfish, halibut, and pollock destroy cod.] Report, 1878 (1880), p. 712–713.

Fisher, F. B.: [Predacious fish in Florida.] Bulletin, 1881 (1882), vol. I, p. 251.

Goode, G. Brown: [Predacious foes of the menhaden.] Report, 1877 (1879), p. 104–110.

Hathaway, Walter E.: [Effects on the menhaden fishery of predatory fishes.] Bulletin, 1907 (1908), vol. XXVIII, p. 275–277.

Kendall, William Converse: [Relation of menhaden to fishes that feed upon them.] Bulletin, 1908 (1910), vol. XXVIII, p. 290–293.

[Pike as an enemy of carp.] Bulletin, 1882 (1883), vol. II, p. 3.

Ryder, John Adam: [Notes on small fishes and water animals which prey on fish larvæ.] Bulletin, 1882 (1882), vol. II, p. 193–195.

——— Carp do eat young fishes. Bulletin, 1884 (1884), vol. IV, p. 152. F18–258

Sars, George Ossian: [Pollock destroy cod.] Report, 1877 (1879), p. 593.

Smith, Hugh McCormick: [Enemies of the menhaden.] Bulletin, 1895 (1896), vol. XV, p. 299.

Stranahan, J. J.: [Feeding pike perch fry to prevent cannibalism.] Report, 1894 (1896), p. 39.

White, C. M.: Ability of carp to endure muddy, slimy, and stagnant water. Bulletin, 1883 (1883), vol. III, p. 444. F18–176

ARRANGEMENT BY FAMILIES.

SELACHII.

Bartlett, John R.: [Sharks.] Bulletin, 1884 (1884), vol. IV, p. 315.

Collins, Joseph William: Appearance of dogfish (*Squalus acanthias*) on the New England coast in winter. Bulletin, 1882 (1883), vol. II, p. 8. F18–60

Gallup, B. Frank: Catching dogfish for oil and guano. Bulletin, 1882 (1883), vol. II, p. 246. F18–99

Goode, George Brown: [The rays, torpedoes, and skates—Raiæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 665–668.

Goode, George Brown: [The saw-fish—*Pristis pectinatus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 668.

——— [The sharks—Squali.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 668–675.

The **Iceland** shark-fisheries. Bulletin, 1885 (1885), vol. V., p. 301-304. F18–448

Jordan, David Starr: The sharks of the Pacific coast. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 675–676.

Moore, Henry Frank: The grayfish. Try it. It knocks H out of the H. C. of L. 8 p., illus. *Economic Circular 22 issued Nov. 29, 1916.* F17–107

——— Skates and rays. Interesting fishes of great food value, with 29 recipes for cooking them. 7 p., illus. *Economic Circular 34 issued Mar. 20, 1918.* F18-516

Parker, George Howard: Influence of the eyes, ears, and other allied sense organs on the movements of the dogfish, *Mustelus canis* (Mitchill). (List of references: p. 55-57.) Bulletin, 1909 (1910), vol. XXIX, p. 43-57. *Doc. 738 issued Nov. 18, 1910.* F10–1

——— The directive influence of the sense of smell in the dogfish. (Bibliography: p. 68.) Bulletin, 1913 (1914), vol. XXXIII, p. 61–68. *Doc. 798 issued Aug. 8, 1914.* F14–99

Radcliffe, Lewis: The sharks and rays of Beaufort, North Carolina. (Bibliography: p. 281–282.) Bulletin, 1914 (1916), vol. XXXIV, p. 239–284, illus., pl. XXXVIII–XLIX. *Doc. 822 issued Apr. 6, 1916.* F16–81

——— Sharks as food. With thirty recipes. 8 p. *Economic Circular 35 issued Apr. 29, 1918.* F18–683

Smith, Hugh McCormick: [A large skate.] Bulletin, 1894 (1895), vol. XIV, p. 287.

MARSIPOBRANCHII.

PETROMYZONTIDÆ.

Goode, George Brown: Notes on the lampreys (Petromyzontidæ). Bulletin, 1882 (1883), vol. II, p. 349–354. F12–372

——— [The lampreys—Petromyzontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 677–681.

Riddle, George W.: Restocking the Merrimac River with lamprey eels. Bulletin, 1885 (1885), vol. V, p. 320. F18–464

Surface, H. A.: The lampreys of central New York. Bulletin, 1897 (1898), vol. XVII, p. 209–215, illus., pl. 10–11. *Doc. 372 issued Aug. 5, 1898.* F12–110

TELEOSTII.

ACIPENSERIDÆ.

Borodin, N.: An attempt to impregnate artificially the eggs of *Acipenser stellatus.* Bulletin, 1885 (1885), vol. V, p. 275–277. F18–436

Cobb, John Nathan: The sturgeon fishery of Delaware River and bay. Report, 1899 (1900) , p. 369–380, pls. 18–21. *Doc. 429 issued Aug. 25, 1900.* F11–110

Dean, Bashford: Recent experiments in sturgeon hatching on the Delaware River. Bulletin, 1893 (1894), p. 235–239, illus. *Doc. 269 issued 1894.* F12–183

Goode, George Brown: [The sturgeons—Acipenseridæ]. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 660–663.

Hovey, Horace Carter: The sturgeon fishery. Bulletin, 1884 (1884), vol. IV, p. 346–348. F14–114

Radcliffe, Lewis: Caviar: what it is and how to prepare it. 8 p., illus. (Selected bibliography: p. 7–8.) *Economic Circular 20 issued Apr. 19, 1916.* F16–86

Ryder, John Adam: The sturgeons and sturgeon industries of the eastern coast of the United States, with an account of experiments bearing upon sturgeon culture. (Literature relating to the sturgeon: p. 279–280.) Bulletin, 1888 (1890), vol. VIII, p. 231–328, pl. XXXVI–LIX. *Doc. 143 issued Mar. 25, 1891.* F11–324

U. S. Bureau of Fisheries: The artificial propagation of sturgeon in Schleswig-Holstein, Germany. Bulletin, 1889 (1891), vol. IX, p. 81–90. *Doc. 151 issued May 29, 1891.* F12–139

ALBULIDÆ.

Goode, George Brown: [The lady-fish family—Albulidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 612.

ALEPIDOSAURIDÆ.

Goode, George Brown: [The handsaw fish family—Alepidosauridæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 547-548.

ALEPOCEPHALIDÆ.

Goode, George Brown: [The Alepocephalus family—Alepocephalidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 548.

AMBLYOPSIDÆ.

Cox, Ulysses Orange: A revision of the cave fishes of North America. Report, 1904 (1905), p. 377–393. IV pl. *Doc. 579 issued Sept. 5, 1905.* F10–7

AMIIDÆ (AMIATIDÆ).

Coker, Robert Ervin: The bowfin: an old-fashioned fish with a new-found use. 4 p., illus. *Economic Circular 26 issued May 11, 1917.* F17–188

Goode, George Brown: [The bowfins—Amiidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 659–660.

Shufeldt, Robert Wilson: The osteology of *Amia calva*, including certain special references to the skeleton of Teleosteans. Report, 1883 (1885), 132 p., XIV pl. *Doc. 90 issued Mar. 19, 1885.* F11–305

AMMODYTIDÆ.

Goode, George Brown: [The lant, or sand eel—*Ammodytes americanus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 244–246.

ANARHICHADIDÆ.

Goode, George Brown: [The wolf fishes or sea catfishes—Anarhichadidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, 248–250.

ANGUILLIDÆ.

Brocchi, P.: [Eels.] Bulletin, 1886 (1887), vol. VI, p. 136.

Eels in tanks and ponds. Bulletin, 1886 (1887), vol. VI, p. 91–92. F18–545

Goode, George Brown: [The eel—*Anguilla vulgaris*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 630–658.

——— Notes on the life history of the eel, chiefly derived from a study of recent European authorities. (A list of the most important papers concerning the eel and its reproduction: p. 112–124.) Bulletin, 1881 (1882), vol. I, p. 71–124, illus. F12–335

Hermes, Otto: [The propagation of the eel.] Report, 1879 (1882), p. 457–462, illus. F17–2

——— On the mature sexual organs of the conger eel (*Conger vulgaris*), with some observations on the male of the common eel (*Anguilla vulgaris* Flemming). Bulletin, 1881 (1882), vol. I, p. 126–130. F12–316

——— The migration of eels. Report, 1884 (1886), p. 1123–1126. F17–139

Hinkelmann, Herr: The mode of life of eels. Bulletin, 1884 (1884), vol. IV, p. 389–390. F18–345

Jacoby, Leopold: The eel question. Report 1879 (1882), p. 463–483. F17–3

Jordan, David Starr, and Bradley M. Davis: A preliminary review of the apodal fishes or eels inhabiting the waters of America and Europe. Report, 1888–89 (1892), p. 581–677. *Doc. 184 issued June 30, 1892.* F12–226

Lundberg, Rudolph: Eel fishing with so-called "hommor" (a species of fishpot) on the Baltic coast of Sweden and in the Sound. Report, 1883 (1885), p. 415–430, pl., illus. F17–33

Meek, Seth Eugene: A note on the Atlantic species of the genus *Anguilla*. Bulletin, 1883 (1883), vol. III. p. 430, incl. table. F18–163

——— A note on the Cuban eel. Bulletin, 1884 (1884), vol. IV, p. 111. F13–87

Norny, E. R: Artificial propagation of rockfish and eels. Bulletin, 1885 (1885), vol. V, p. 315. F18–461

Nye, Willard: Eels (*Anguilla rostrata*) in New Bedford water pipes. Bulletin, 1882 (1883), vol. II, p. 272. F18-102

Pavesi, Pietro: Observations on male eels. Bulletin, 1886 (1887), vol. VI, p. 222-224. F18-583

Ryder, John Adam: Note on the male organs of the eel. Bulletin, 1885 (1885), vol. V, p. 1-3. F18-364

Sawyer, J. N.: The breeding habits of the eel. Bulletin, 1886 (1887), vol. VI, p. 218-219. F18-581

Syrski: Lecture on the organs of reproduction and the fecundation of fishes and especially of eels. Report, 1873-74 and 1874-75 (1876), p. [719]-734, illus. F16-34

Thompson, Edward H: Notes on the breeding of eels. Bulletin, 1884 (1884), vol. IV, p. 208. F18-283

ANTENNARIIDÆ.

Goode, George Brown: [The devil fishes—Antennariidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 173.

ATHERINIDÆ.

Goode, George Brown: [The sand smelts or silversides—Atherinidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 456-457.

Kendall, William Converse: Notes on the silversides of the genus Menidia of the east coast of the United States, with descriptions of two new subspecies. Report, 1901 (1902), p. 241-267, illus. *Doc. 492 issued Apr. 28, 1902.* 6-800

Ryder, John Adam: On the thread-bearing eggs of the silversides (Menidia). Bulletin, 1883 (1883), vol. III, p. 193-196, illus. F12-380

BALISTIDÆ.

Goode, George Brown: [The file-fish family—Balistidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 171-172.

Luce, Thomas R.: Occurrence of *Balistes capriscus* Gmelin (leather-jacket or file-fish). at New Bedford, Mass. Bulletin, 1883 (1883), vol. III, p. 469. F18-193

Van Mater, J. H.: Occurrence of *Balistes vetula* on the New Jersey coast. Bulletin. 1884 (1884), vol. IV, p. 13. F18-203

BATRACHOIDIDÆ.

Goode, George Brown: [The toad-fish—*Batrachus tau*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 251-253.

Gudger, Eugene Willis: Habits and life history of the toad-fish (*Opsanus tau*). (Literature cited: p. 1107-1109.) Bulletin, 1908 (1910), vol. XXVIII, p. 1071-1109, pl. CVII-CXIII. *Doc. 709 issued Apr. 30, 1910.* 10-35604

BELONIDÆ.

Goode, George Brown: [The silver garfishes—Belonidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 458-459.

BERYCIDÆ.

Goode, George Brown: [The Beryx family—Berycidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 361.

BLENNIIDÆ.

Goode, George Brown: [The blenny family—Blenniidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 250-251.

Smith, Hugh McCormick: Description of a new species of blenny from Japan. Bulletin, 1901 (1902), vol. XXI, p. 93-94. *Doc. 485 issued Mar. 28, 1902.* F12-270

BRAMIDÆ.

Goode, George Brown: [The hen-fish family—Bramidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 335.

BRANCHIOSTOMIDÆ.

Goode, George Brown: [The lancelets—Branchiostomidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 682.

BROTULIDÆ.

Goode, George Brown: [The red cusk family—Brotulidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 244.

CARANGIDÆ.

Goode, George Brown: The carangoid fishes of the United States—pompanos, crevalles amber-fish, etc. Bulletin, 1881 (1882), vol. I, p. 30–43. F12–332

——— [The silver moon-fishes.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 322–323.

——— [The cavally, the scad, and the jurels.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 323–326.

——— [The pompanos—*Trachynotus carolinus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 326–331.

——— [The pilot-fish—*Naucrates ductor.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 330–331.

——— [The amber-fishes and the leather-jackets.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 331–332.

CATOSTOMIDÆ.

Dresser, Henry: Notes on the natural history of the buffalo. Bulletin, 1883 (1883), vol. III, p. 436. F18–167

Evermann, Barton Warren: Description of a new sucker, *Pantosteus jordani,* from the upper Missouri basin. Bulletin, 1892 (1894), vol. XII, p. 51–56, illus. *Doc. 207 issued Jan. 27, 1893.* F12–125

Jordan, David Starr: [The sucker family—Catostomidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 614–615.

Mosher, A. A.: Propagating buffalo fish. Bulletin, 1885 (1885), vol. V, p. 190. F18–403

CENTRARCHIDÆ.

Arnold, Isaac: Successful propagation of black bass. Bulletin, 1882 (1883), vol. II, p. 113–115. F18–85

Bartlett, Sylvester P.: The cultivation of crappies in ponds. Bulletin, 1883 (1883), vol. III, p. 362. F18–146

Bollman, Charles Harvy: A review of the Centrarchidæ or fresh-water sunfishes of North America. Report, 1888–89 (1892), p. 557–579, pl. LXVIII–LXXII. *Doc. 190, issued June 30, 1892.* F12–228

Borne, Max von dem.: The American black bass. Bulletin, 1882 (1883), vol. III, p. 221–224. F12–392

——— Spawning in Germany of the large-mouthed black bass sent from the United States in 1882. Bulletin, 1884 (1884), vol. IV, p. 219. F18–288

——— Report on black bass sent from America to Germany in 1883. Bulletin, 1884 (1884), vol. IV, p. 384. F18–342

Clagett, J. C.: [A large bass from the Potomac River.] Bulletin, 1884 (1884), vol. IV, p. 470.

Duclos, Gilbert: American silver perch, or calico bass. Bulletin, 1887 (1889), vol. VII, p. 215–216. F18–672

Goode, George Brown: [The black bass family—Centrarchidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 401–404.

Hensman, John T.: American black bass placed in the River Nene, England. Bulletin, 1884 (1884), vol. IV, p. 166. F18–261

Jordan, David Starr: [The sunfishes and their allies.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 404–407.

Lydell, Dwight: The habits and culture of the black bass. Bulletin, 1902 (1903), vol. XXII, p. 39–44, pl. 8. *Doc. 513 issued Feb. 26, 1903.* F12–57

Page, William F.: The propagation of black bass in ponds. Bulletin, 1893 (1894), vol. XIII, p. 229–236. *Doc. 259 issued 1894.* F12–183

Pearse, Arthur Sperry: Habits of the black crappie in inland lakes of Wisconsin. Appendix III, Report, 1918 (1920), 16 p., illus. *Doc. 867 issued June 24, 1919.* F12–29

Sharp, John: The large-mouthed black bass in Utah. Bulletin, 1897 (1898), vol. XVII, p. 363–368. *Doc. 395 issued 1898.* F12–110

Smiley, Charles Wesley: Removal of bass from Indiana to North Carolina by the United States Fish Commission. Bulletin, 1882 (1883), vol. II, p. 116. F18–86

Smith, Hugh McCormick: The common names of the basses and sunfishes. (Bibliography: p. 365–366.) Report, 1902 (1904), p. 353–366. *Doc. 538 issued Sept. 19, 1903.* F11–8

CHIMÆRIDÆ.

Goode, George Brown: [The Chimæra family—Chimaeridæ.] *In* the fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 663.

CHIRIDÆ.

Jordan, David Starr: [The rock trouts—Chiridæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 267–268.

CICHLIDÆ.

Goode, George Brown: [The demoiselle and the cichlid families.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 275–276.

CLUPEIDÆ.

Abbe, W. A.: Proposed limitation of menhaden fishing to July 1, and of mackerel fishing to June 15. Occurrence of herring. Bulletin, 1883 (1883), vol. III, p. 468–469. F18–192

Babbitt, John O.: The injurious effect of menhaden steamers upon the food fisheries. Bulletin, 1883 (1883), vol. III, p. 463–464. F18–189

Babcock, William C.: Report of shad operations conducted at Fort Washington, Maryland. Report, 1883 (1885), p. 1035–1041; 1884 (1885), p. 189–192, pl. F17–35

Barker, E. L.: The incipiency of the menhaden oil business. Bulletin, 1883 (1883), vol. III, p. 456. F18–184

Bean, Tarleton Hoffman: Movements of young alewives (?) (Pomolobus sp.) in Colorado River, Texas. Bulletin, 1881 (1882), vol. I, p. 69–70. F18–27

——— [On the occurrence of the branch alewife in certain lakes of New York.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 588–593.

Blackford, Eugene Gilbert: Catch of shad in the Hudson River for 1885. Bulletin 1886 (1887), vol. VI, p. 294. F18–595

Boeck, Axel., i. e., Jonas Axel and A. Fedderson: The Norwegian herring fisheries. Report, 1873–5 (1876), p. 97–122. F16–7

Buch, Sophus Andreas: Spawning of spring herring near Norway. Bulletin, 1885 (1885), vol. V, p. 297–301. F18–447

Carr, T. F. Robertson: Notes on the Scotch herring fisheries. Bulletin, 1884 (1884), vol. IV, p. 60, 64 and 431. F18–221, F18–228, F18–356

Cary, H. H.: The Saint John's River as a shad stream. Bulletin, 1885 (1885), vol. V, p. 422. F18–489

Chalker, Robert B.: Catch of shad in Connecticut for 1885, 1886, and 1887. Bulletin, 1886 (1886), vol. VI, p. 297–298, 439–441; 1887 (1887), vol. VII, p. 112. F18–597

Chapman, Pearson: Habits of the shad and herring as they appear in the Potomac River to one who has watched them for fifty years. Bulletin, 1884 (1884), vol. IV, p. 61-64. F13–81

Church, Daniel T.: Why the size of mesh in menhaden seins should not be restricted. Bulletin, 1883 (1883), vol. III, p. 463. F18–188

Clark, Frank Nelson: Report of experiments for determining the smallest amount of water in which young shad and eggs can be kept. Report, 1881 (1884), p. 783–786. F16–340

——— Notes on experiments in penning shad and taking eggs at Battery station, Havre de Grace, Md., in 1883. Report, 1883 (1885), p. 1045–1050. F17–37

Collins, Joseph William: Shad taken in mackerel gill-nets. Bulletin, 1882 (1883), vol. II, p. 95. F18–79

Collins, Joseph William: Notes on the herring fishery of Massachusetts Bay in the autumn of 1882. Bulletin, 1882 (1883), vol. II, p. 287–290. F12–264

Crittenden, A. R.: Catching alewives with hooks baited with eels. Bulletin, 1884 (1884), vol. IV, p. 255–256. F18–302

Daniell, William C.: Letters referring to the experiments of W. C. Daniell, M. D., in introducing shad into the Alabama River. Report, 1872 and 1873 (1874), p. 386–390. F15–108

De Blois, E. T.: The origin of the menhaden industry. Bulletin, 1881 (1882), vol. I, p. 46–51. F12–333

Dempsey, W.: Shad in the St. John's River, Florida. Bulletin, 1886 (1887), vol. VI, p. 96. F18–547

Earll, R. Edward and Hugh M. Smith: The American sardine industry in 1886. Bulletin, 1887 (1888), vol. VII, p. 161–192. fold. map. F11–252

Eckardt, R.: The experiments in propagating maifische (*Alosa vulgaris*) in 1876 and 1877. Report, 1877 (1879), p. [853]–866. F16–122

Evermann, Barton Warren: Description of a new species of shad (*Alosa alabamæ*) from Alabama. Report, 1895 (1896), p. 203–205. *Doc. 335 issued Dec. 28, 1896.* F11–198

——— Description of a new species of shad (*Alosa ohiensis*), with notes on other food fishes of the Ohio River. Report, 1901 (1902), p. 273–288. *Doc. 499 issued May 26, 1902.* F11–24

Ewart, James Cossar: On the natural and artificial fertilization of sea herring eggs. Bulletin, 1884 (1884), vol. IV, p. 193–197. F13–95

Ferguson, Thomas B.: Extracts from a report of investigations of the shad fisheries and rivers south of Charleston, S. C., with a view to establishing stations for artificial propagation. Bulletin, 1884 (1884), vol. IV, p. 244–248. F18–299

Finely, Charles I.: Shad in Oregon waters—A new salmon hatchery. Bulletin, 1884 (1884), vol. IV, p. 88. F18–236

Finn, W.: The Iceland herring fisheries. Report, 1879 (1880), p. 493–496. F17–5

——— Can herring live and increase in enclosed waters? Bulletin, 1884 (1884), vol. IV, p. 333–335. F18–325

Fishing for shad in South American waters. Bulletin, 1882 (1883), vol. II, p. 138. F18–92

Friedlaender, Oscar O.: Notes on the menhaden industry. Bulletin, 1882 (1883), vol. II, p. 252. F18–100

——— Notes on the menhaden fishery. Bulletin, 1883 (1883), vol. III, p. 459–461. F18–186

——— Notes on the menhaden fishing of 1883. Bulletin, 1884 (1884), vol. IV, p. 47–48. F11–211

Gifford, George: The disappearance of sardines from the Vendean coast, and its causes. Bulletin, 1882 (1883), vol. II, p. 13–14. F18–63

Goode, George Brown: The natural and economical history of the American menhaden. (Menhaden and other fish and their products as related to agriculture, by W. O. Atwater: p. 194–266.) Report, 1877 (1879), 529 p. F12–236

——— [The herring family—*Clupea harengus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 549–568.

——— [The menhaden—*Brevoortia tyrannus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 569–575.

——— [The Gulf menhaden—*Brevoortia patronus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 575–577.

——— [The inland alewife or skipjack—*Clupea chrysochloris.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 594.

Grant, Isaac H.: Movements of menhaden—Catch of herring. Bulletin, 1883 (1883), vol. III, p. 470. F18–195

Greer, Rob Leon: The menhaden industry of the Atlantic coast. Appendix III, Report, 1914 (1915), 27 p., VII pl. (incl. front.). *Doc. 811 issued Apr. 7, 1915.* F15–39

——— The menhaden industry of the Atlantic coast. (Selected bibliography of papers relating to fish fertilizer: p. 30.) 30 p., VII pl. (incl. front.). *Doc. 811 reprinted with additions Oct. 18, 1917.* F17–263

Griffith, William: Results of planting shad in the Ohio River. Bulletin, 1882 (1883), vol. II, p. 12. F18–62

Hall, Ansley: The herring industry of the Passamaquoddy region, Maine. Report, 1896 (1898), p. 443–487 incl. tables. *Doc. 360 issued 1897.* F11–183

Hamlen, William: Reconnaissance of Florida rivers with a view to shad hatching. Bulletin, 1884 (1884), vol. IV, p. 206–208. F13–9

Harding, Charles William: Inquiries concerning the propagation of Severn smelt and shad, and notes on the fisheries of the Wash in England. Bulletin, 1881 (1882), vol. I, p. 428–429. F18–58

Harrell, J. Dock: Trapping gaspereau in Tangipahoa River. Bulletin, 1884 (1884), vol. IV, p. 448. F18–361

Harris, Gwynn: Report upon the shad and herring fisheries of the Potomac River for 1882–1886. Bulletin, 1883 (1883), vol. III, p. 477; 1884 (1884), vol. IV, p. 13, 221; 1885 (1885), vol. V, p. 192; 1886 (1886), vol. VI, p. 202. F18–202

Hawkins, J. W.: An opinion regarding the influence upon the coast fisheries of the steamers used in the menhaden fishery. Bulletin, 1881 (1882), vol. I, p. 266–268. F18–52

Hildebrand, Samuel Frederick: Two species of menhaden occurring on the coast of North Carolina. Appendix VI, Report, 1918 (1920), 7 p., illus., pl. *Doc. 871 issued Aug. 13, 1919.* F19–37

Homergue, Louis C. d': Reasons for restricting the use of steamers and seines in the menhaden industry. Bulletin, 1883 (1883), vol. III, p. 456–458. F18–185

Huske, C. J.: Shad fishing on the Edisto River. Bulletin, 1884 (1884), vol. IV, p. 165. F18–260

——— Report on the shad work in South Carolina in 1883. Transportation of shad eggs on trays. Bulletin, 1884 (1884), vol. IV, p. 161–164. F13–91

Jann, P. F.: Catch of shad in the Delaware River for 1885 and 1886. Bulletin, 1886 (1887), vol. VI, p. 301–302. F18–599

Jensen, Olaf Scheveland: Report on the practical and scientific investigations of the spring herring fisheries during the year 1880, submitted to the Department of the interior. Report, 1880 (1883), p. 127–161. F16–288

Jordan, David Starr: [The herrings of the Pacific coast—Clupea mirabilis.] *Quoted by* G. Brown Goode *in* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 568–569.

Kemp, N. H., and others: The sardine canning industry of Eastport, Maine. (A petition to the Secretary of the treasury.) Bulletin, 1885 (1885), vol. V, p. 241–243. F18–416

Laighton, Cedric: The capture of shad at Isles of Shoals, New Hampshire. Bulletin, 1881 (1882), vol. I, p. 421. F18–54

Lanman, Charles: The shad and gaspereau or alewife of New Brunswick and Nova Scotia. Report, 1872 and 1873 (1874), p. 461–462. F16–66

Lennurt, J. T.: Catch of spawning shad in the Potomac, above Georgetown. Bulletin, 1883 (1883), vol. III, p. 440. F18–171

Ljungman, Axel Vilhelm: Preliminary report for 1873–74 on the herring and the herring fisheries on the west coast of Sweden. Report, 1873–74 and 1874–75 (1876), p. 123–168. F16–8

——— The salt-water fisheries of Bohuslan and the scientific investigations of the salt-water fisheries. Report, 1878 (1880), p. 143–220. F16–157

——— The great Bohuslan herring-fisheries. Report, 1878 (1880), p. 221–239. F16–158

——— The propagation and growth of the herring and small-herring, with special regard to the coast of Bohuslan. Report, 1878 (1880), p. 639–659. F16–172

——— Contribution towards solving the question of the secular periodicity of the great herring fisheries. Report, 1879 (1882), p. 497–503. F17–6

——— Contributions towards a more correct knowledge of the herring's mode of life. Report, 1879 (1882), p. 505–513. F17–7

——— What should be done by the government with regard to the great Bohuslan herring fisheries. A memorial addressed to the Council of state and the head of the Royal civil department [of Sweden]. Report, 1880 (1883), p. 99–126. F16–291

——— The great herring fisheries considered from an economical point of view. Report, 1883 (1885), p. 341–357. F17–30

——— Special results of the investigations relating to herring and herring fisheries on the west coast of Sweden made during the years 1873–1883. Report, 1883 (1885), p. 729–745. F17–34

——— The future of the herring fisheries on the coast of Bohuslan. Report, 1884 (1886), p. 399–409. F17–132

McDonald, Marshall: [The shad and the alewives.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 579–609.

——— Effect of waste products from Page's ammoniacal works upon young shad fry. Bulletin, 1885 (1885), vol. V, p. 313–315. F18–460

Mather, Fred: The shad fisheries of the Hudson. Bulletin, 1885 (1885), vol. V, p. 177–180. F18–398

Meyer, Heinrich Adolf: Biological observations made during the artificial raising of herrings in the western Baltic. Report, 1878 (1880), p. 629–638. F16–189

Milner, James W.: Report on the propagation of the shad (*Alosa sapidissima*) and its introduction into new waters by the U. S. fish commission in 1873. Report, 1872 and 1873 (1874), p. 419–451. F15–111

——— Summary of fishing records, for shad and alewives kept at Willow Branch fishery, North Carolina, from 1835 to 1874. Bulletin, 1881 (1882), vol. I, p. 396–400 incl. tables. F12–338

Moore, Henry Frank: Observations on the herring and herring fisheries of the northeast coast, with special reference to the vicinity of Passamaquoddy Bay. Report, 1896 (1898), p. 387–442, pl. 60–62. *Doc. 356 issued Feb. 8, 1898.* F11–182

Mordecai, E. R.: Food of the shad of the Atlantic coast of the United States (*Alosa praestabilis* DeKay); and the functions of the pyloric coeca. Bulletin, 1881 (1882), vol. I, p. 277–282. F12–322

New contributions to the herring question. The dispute between Axel Boeck and Ossian Sars regarding the Norwegian summer-herring. Sars' recent observations and his new theory on the migrations of the herrings. Report 1873–74 and 1874–75 (1876), p. 195–211. F16–12

Osborn, John H.: Shad fishing on the Saint John's River. Bulletin, 1882 (1883), vol. II, p. 132. F18–89

Page, William F.: Effect of sunlight upon shad eggs. Bulletin, 1885 (1885), vol. V, p. 308. F18–453

Polk, William R.: Experience of a menhaden oil manufacturer in Northumberland County, Va. Bulletin, 1883 (1883), vol. III, p. 455. F18–183

Rice, Henry J.: Experiments upon retarding the development of eggs of the shad, made in 1879, at the United States shad-hatching station at Havre de Grace, Md. Report, 1881 (1884), p. 787–794. illus. F16–341

Ryder, John Adam: The Protozoa and Protophytes considered as the primary or indirect source of the food of fishes. Bulletin, 1881 (1882), vol. I, p. 236–251. F12–336

——— Additional observation on the retardation of the development of the ova of the shad. Bulletin, 1881 (1882), vol. I, p. 422–424. F12–340

——— Observations on the absorption of the yelk, the food, feeding, and development of embryo fishes, comprising some investigations conducted at the Central hatchery Armory building, Washington, D. C., in 1882. Bulletin, 1882 (1883), vol. II, p. 179–205. illus. F12–357

——— The Protozoa and Protophytes considered as the primary or indirect source of the food of fishes. Report, 1881 (1884), p. 755–770. F16–338

——— On the retardation of the development of the ova in the shad (*Alosa sapidissima*) with observations on the egg fungus and bacteria. (Second series of experiments conducted in association with Col. M. McDonald.) Report, 1881 (1884), p. 795–811. F16–342

The **Sardine** fisheries. Report, 1880 (1883), p. 163–165. F17–298

The **Scotch** herring fisheries. Bulletin, 1882 (1883), vol. II, p. 117–118; 1883 (1883), vol. III, p. 472. F18–87

Smith, Everett: Results of planting shad in the Kennebeck River. Bulletin, 1887 (1889), vol. VII, p. 16. F18–637

Smith, Hugh McCormick: The French sardine industry. Bulletin, 1901 (1902), vol. XXI. 26 p. *Doc. 473 issued Sept. 26, 1901.* F12–266

Swan, James G.: Shad in Puget Sound. Bulletin, 1882 (1883), vol. II, p. 152. F20–143

U. S. Bureau of Fisheries: Letters referring to the presence of shad in the rivers tributary to the Gulf of Mexico. [From John T. Knight, Isaac Pollard, George Lawrence, Will E. Turner, Holmes A. Pattison.] Report, 1872 and 1873 (1874), p. 391–395. F16–64

——— The propagation and distribution of the shad. A. Operations in the distribution of shad in 1874, by J. W. Milner. B. Report on shad hatching in New Jersey, by G. A. Anderson. C. Voyage to Bremerhaven, Germany, with shad, by F. Mather. D. Living shad on their way to Weser. E. Shad hatching and distribution operations of 1875. Report, 1873–74 and 1874–75 (1876), p. 323–349. F16–18

——— On the transportation of shad for long distances. A. Experiments with a view to transporting shad in sea-water, by James W. Milner. B. Experiments with a view to transporting shad a few months old, by Charles D. Griswold. C. Apparatus for hatching shad-ova while en route to new waters, by Fred Mather. Report, 1873–74 and 1874–75 (1876), p. [363]–376, illus. F16–20

Vail, David F.: Why the catching of menhaden with seines, etc., should be restricted. Bulletin, 1883 (1883), vol. III, p. 469. F18–194

Wharton, Joseph: Why menhaden seining should not be prohibited within two miles of the shore. Bulletin, 1883 (1883), vol. III, p. 462. F18-187

Widegren, Hjalmar: On the herring, and its preparation as an article of trade. Report, 1873-74 and 1874-75 (1876), p. 183-193. F16-11

Wilcox, William A.: Notes on the frozen-herring trade with Newfoundland and the Bay of Fundy during the winter of 1886-87. Bulletin, 1887 (1889), vol. VII, p. 71-73 incl. tables. F18-655

Willis, H.: Shad fisheries of the Susquehanna River fifty-six years ago. Bulletin, 1881 (1882), vol. I, p. 261-263. F18-49

Wood, William Maxwell: Report of an examination of the shad fisheries in Georgetown, S. C. Bulletin, 1884 (1884), vol. IV, p. 140-141. F18-249

——— Report of a trip made by the *Fish Hawk* to the lower part of Chesapeake Bay, to ascertain the character of the fisheries for shad, herring, etc., in the spring of 1884. Bulletin, 1884 (1884), vol. IV, p. 199-200. F18-281

——— Report of a trip by steamer *Fish Hawk* to the Saint Mary's and Saint John's rivers to hatch shad. Bulletin, 1884 (1884), vol. IV, p. 241-242. F18-297

——— Reconnaissance of the shad fisheries of Winyaw Bay and its tributaries by the steamer *Fish Hawk*. Bulletin, 1884 (1884), vol. IV, p. 242-243. F18-298

Worth, Stephen G.: Shad hatching and carp culture. Bulletin, 1882 (1883), vol. II, p. 26-27. F18-71

——— A poor season for shad hatching in North Carolina. Bulletin, 1882 (1883), vol. II, p. 54. F18-74

——— Observations on the spawning habits of the shad. Bulletin 1891 (1893), vol. XI, p. 201-206. *Doc. 209 issued Mar. 11, 1893.* F12-127

——— Possible expansion of shad-hatchery work. Bulletin, 1908 (1910), vol. XXVIII, part II, p. 789-793. *Doc. 678 issued April, 1910.* 10-35420

Wright, Harrison: On the early shad fisheries of the north branch of the Susquehanna River. Report, 1881 (1884), p. 619-642. F16-334

Wyoming Historical and Geological Society, Wilkesbarre, Pa.: Report of a committee of the Wyoming historical and geological society on the early shad fisheries of the north branch of the Susquehanna River. By Harrison Wright, chairman of the committee. Bulletin, 1881 (1882), vol. I, p. 352-379. F11-218

Yarrow, Harry Crécy: Report of a reconnaissance of the shad rivers south of the Potomac. Report, 1872 and 1873 (1874), p. 396-402. F15-109

——— Notes on the natural history of the shad as observed at Beaufort, North Carolina. Report, 1872 and 1873 (1874), p. 452-455. F15-112

CORYPHÆNIDÆ.

Goode, George Brown: [The dolphins—Coryphaenidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 332.

COTTIDÆ.

Goode, George Brown: [The sculpin tribe—Cottidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 258-260.

Greeley, Arthur White: Notes on the tide-pool fishes of California, with a description of four new species. Bulletin, 1899 (1901), vol. XIX, p. 7-20, illus. *Doc. 425 issued Dec. 13, 1899.* F12-41

CYPRINIDÆ.

Barnes, A. G.: Growth and spawning of German carp in Alabama. Bulletin, 1881 (1882), vol. I, p. 424-425. F18-56

Behr, Friedrich von: Management of spawning carp. Bulletin, 1883 (1883), vol. III, p. 392. F18-148

——— Five recipes for cooking carp. Bulletin, 1886 (1887), vol. VI, p. 276.

Blackford, E. G.: Carp in an instalment of shad from James River. Bulletin, 1884 (1884), vol. IV, p. 112. F18-237

Borne, Max von dem: Raise carp. Report, 1880 (1883), p. 673-680. F16-274

——— How to raise carp and other pond fish which spawn in summer. Report, 1883 (1885), p. 1133-1142. F11-248

——— A large catch of carp. Bulletin, 1886 (1887), vol. VI, p. 116. F18-554

Brakeley, John H.: Plants for carp ponds. Bulletin, 1884 (1884), vol. IV, p. 159-160. F18-259

Butcher, E. Z.: How to avoid a soft or muddy taste of carp. Bulletin, 1884 (1884), vol. IV, p. 205. F18-282

Canfield, Harry L.: The capture and marketing of carp. Seasons and localities of capture. 7 p. *Economic Circular 40 issued Sept. 20, 1918.* F18-699

The **Carp** fisheries in the Peitz Lakes. Report, 1878 (1880), p. 675–678. F16–176

Carp in France. Bulletin, 1886 (1887), vol. VI, p. 203-204. F18–574

The **Carp** ponds belonging to the State of Texas. Bulletin, 1884 (1884), vol. IV, p. 230–231. F18–293

Cary, H. H.: Period of incubation of eggs of German carp. Bulletin, 1883 (1883), vol. III, p. 447. F18–179

Cole, Leon Jacob: The German carp in the United States. (Bibliography: p. 637–641.) Report, 1904 (1905), p. 523–641, illus., III pl. *Doc. 592 issued Dec. 30, 1905.* F12–327

Couchman, J. W.: Transporting carp from the United States Fish commission to Brazil. Bulletin, 1882 (1883), vol. II, p. 382. F18–110

On the **culture** of the carp. A. On carp ponds, by A. F. B. Carp culture in East Prussia, by R. Struvy. C. Carp ponds. (From Landwirthschaft und industrie. Berlin, 1875. Tr. by C. F. Himes.) Report, 1873–74 and 1874–75 (1876), p. 549–558. F16–28

Davis, H. B.: Gratifying results of propagating German carp—Bream and carp in ponds together—Table qualities of carp. Bulletin, 1882 (1883), vol. II, p. 317-318. F18–109

Dolge, Alfred: The preparation and cooking of carp. Bulletin, 1886 (1887), vol. VI, p. 204–205. F18–575

Donaldson, R. J.: Raising carp in rice-fields. Bulletin, 1885 (1885), vol. V, p. 283–284. F18–440

Duke, R. T. W.: A four-pound carp lives eight hours out of water by being packed in wet moss. Bulletin, 1884 (1884), vol. IV, p. 16. F18–207

Eben-Bauditten: On carp-culture, chiefly in its relation to agriculture. Report, 1878 (1880), p. 667–670. F15–174

Eckardt, George: The peculiarities of blue carp. Bulletin, 1881 (1882), vol. I, p. 389–390.

——— Carp propagation and blue carp. Bulletin, 1882 (1883), vol. II, p. 168. F18–95

Eckardt-Lübbinchen, R.: Report on the propagation and growth of carp. Report 1879 (1882), p. 671–673. F17–17

Finsch, Otto: Report on the transportation of a collection of living carp from Germany. Report, 1879 (1882), p. 667–670. F17–16

——— [Varieties of carp in Germany.] Bulletin, 1881 (1882), vol. I, p. 220.

——— Report on a trip in Germany to secure carp for the United States Fish commission. Bulletin, 1881 (1882), vol. I, p. 220-225. F18–43

Fuller, Thomas: Carp in England in the seventeenth century. (From "Worthies of England, 1662."). Bulletin, 1884 (1884), vol. IV, p. 14. F18–204

Gaines, Kemp: Growth, spawning, and distribution of German carp reared from 20 fish furnished by the U. S. Fish commission, November 29, 1880. Bulletin, 1882 (1883), vol. II, p. 392. F18–111

Gasch, Adolf: Pond culture—The food and spawning of carp. Report, 1883 (1885), p. 1143–1150. F17–41

Gerber, C.: How to cook carp. Bulletin, 1884 (1884), vol. IV, p. 151–152. F18–257

Gillespie, Samuel: Growth and food of carp. Bulletin, 1882 (1883), vol. II, p. 300. F18–105

Gross, Julius: Another receipt for cooking carp. Bulletin, 1886 (1887), vol. VI, p. 277. F18–591

Hessel, Rudolph: The carp and its culture in rivers and lakes; and its introduction into America. Report, for 1875–76 (1878), p. 865–900, illus. *Doc. 27 issued Apr. 20, 1881.* F12–218

——— Arrival of blue carp from Germany. Bulletin, 1883 (1883), vol. III, p. 443. F18–174

——— [The carp—*Cyprinus carpio.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 618–627.

——— Notes on the habits of the golden ide (*Idus auratus*). Bulletin, 1885 (1885), vol. V, p. 254–255. F18–424

——— Notes from the carp ponds. Bulletin, 1885 (1885), vol. V, p. 435. F18–498

Heyser, E.: Growth of mirror carp sent to Georgia by the U. S. Fish commission. Bulletin, 1882 (1883), vol. II, p. 18. F18–67

How to cook carp and tench. Bulletin, 1884 (1884), vol. IV, p. 139–140. F18–248

Hudson, George A.: Carp caught in Ogeechee River. Bulletin, 1884 (1884), vol. IV, p. 123. F18–241

Hunger, Oscar: Varieties of carp in Saxony. Bulletin, 1883 (1883), vol. III, p. 405. F18–151

Introduction of the aland or orfe into England. Bulletin, 1881 (1882), vol. I, p. 218–220. F18–42

Johnson, Samuel: Growth of German carp sent to Savoy, Texas, by the U. S. Fish commission. Bulletin, 1882 (1883), vol. II, p. 14. F18–64

Jordan, David Starr: [The carp family—Cyprinidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 616–618.

Juday, Chancey: List of fishes collected in Boulder County, Colorado, with description of new species of *Leuciscus*. Bulletin, 1904 (1905), vol. XXIV, p. 223–227, illus. *Doc. 565 issued Mar. 17, 1905.* F12–50

Kirsch, M.: The gold orfe (*Cyprinus orfus*). A. On the raising of the "gold orfe" (*Cyprinus orfus*), by M. Kirsch. B. Correspondence relating to the golde-orfe, by C. Th. E. v. Siebold. Report, 1873–74 and 1874–75 (1876), p. 559–562. F16–29

Leonhardt, G.: Information concerning the blue carp. Bulletin, 1882 (1883), vol. II, p. 15. F18–66

McDonald, Marshall: Experiments in the transportation of the German carp in a limited supply of water. Bulletin, 1881 (1882), vol. I, p. 215–218. F12–321

—— Distribution of German carp by the United States Fish commission. Bulletin, 1882 (1883), vol. II, p. 94. F12–349

Macgowan, Daniel J.: Carp culture in China. Bulletin, 1885 (1885), vol. V, p. 235–241. F18–415

Mackrill, Alfred: A great carp. Bulletin, 1884 (1884), vol. IV, p. 75. F18–226

Martin, Robert A.: How to catch carp. Bulletin, 1885 (1885), vol. V, p. 449–450. F18–506

Mather, Fred: Exchange of live marine specimens with France. Bulletin, 1883 (1883), vol. III, p. 472. F18–198

Matsubara, Shinnosuke: Goldfish and their culture in Japan. Bulletin, 1908 (1910), vol. XXVIII, p. 381–397, col. pl. XVIII–XXVII. *Doc. 666 issued Feb. 26, 1910.* 10–35172

Morriss, T. W.: Spawning of carp in a small basin at Brenham, Texas. Bulletin, 1882 (1883), vol. II, p. 27. F18–72

Mr. Christian Wagner's establishment for raising goldfish, at Oldenberg, Germany. Report, 1878 (1880), p. 679–684. F16–177

Nicklas, Carl: Feeding carp with Indian corn. Bulletin, 1882 (1883), vol. II, p. 168. F18–96

—— Production of young fry of the carp. Bulletin, 1883 (1883), vol. III, p. 401–406. F12–402

—— The artificial feeding of carp. Report, 1882 (1884), p. 1009–1031. F16–324

Palmer, B. D.: Carp appear February 7, take the hook, and are excellent eating. Bulletin, 1884 (1884), vol. IV, p. 124. F18–244

Pasco, I. D.: A call for carp from Nevada. Bulletin, 1881 (1882), vol. I, p. 29–30. F18–13

Peirce, Milton P.: Resuscitation of apparently dead carp. Bulletin, 1884 (1884), vol. IV, p. 183. F18–275

Phillips, Barnet: Holland carp put into the Hudson River about 1830. Bulletin, 1882 (1883), vol. II, p. 25. F18–70

Playfair, Lyon Playfair: A foreigner's opinion of American fish-culture. Bulletin, 1885 (1885), vol. V, p. 367–369. F18–482

Poppe, Robert A.: The introduction and culture of the carp in California. Report, 1878 (1880), p. 661–666. F16–173

Progress and results of fish-culture (German carp). Bulletin, 1881 (1882), vol. I, p. 396. F20–139

Quattlebaum, Paul: Method of catching carp with a hook. Bulletin, 1884 (1884), vol. IV, p. 380. F18–338

Redding, Joseph D.: Character of the carp introduced by Capt Henry Robinson about 1830. Bulletin, 1884 (1884), vol. IV, p. 266–267. F18–308

Reighard, Jacob Ellsworth: Methods of studying the habits of fishes with an account of the breeding habits of the horned dace. (Literature cited: p. 1135–1136.) Bulletin, 1908 (1910), vol. XXVIII, p. 1111–1136, illus., pl. CXIV–CXX. *Doc. 710 issued May 5, 1910.* 10–35605

Riley, Charles Valentine: Water-beetles destroying carp. Bulletin, 1885 (1885), vol. V, p. 311. F18–457

Ryder, John Adam: Carp do eat young fishes. Bulletin, 1884 (1884), vol. IV, p. 152. F18–258

—— Care of goldfish. Queries of William Rosenstihl, jr., with replies. Bulletin 1884 (1884), vol. IV, p. 381–382. F18–339

Smiley, Charles W.: I. Notes on the edible qualities of German carp and hints about cooking them. 2. The German carp and its introduction in the United States. Bulletin, 1884 (1884), vol. III, p. 305–336. *Doc. 66 issued Nov. 29, 1883.* F11–311

—— How to distinguish the sex of carp. Bulletin, 1885 (1885), vol. V, p. 36–37. F18–373

Stocking the Stettiner Haff with carp. Bulletin, 1882 (1883), vol. II, p. 1–8. F18–59

Taylor, Harden Franklin: The carp: a valuable food resource. With twenty-three recipes selected of German, American, and Swedish origin; and also furnished by Frants P. Lund. 1917, 7 p. *Economic Circular 31 issued Sept. 26, 1917.* F17–258

Thompson, Edward: Edible qualities of carp. Bulletin, 1884 (1884), vol. IV, p. 176. F18–268

Trybon, Filip, i. e. Arvid Filip: Carp culture in Sweden. Bulletin, 1886 (1887), vol. VI, p. 156–160. F18–565

—— The tench recommended for cultivation in Sweden. Bulletin, 1886 (1887), vol. VI, p. 209–210. F18–578

Van Antwerp, W.: Growth, edible qualities, and manner of cooking German carp received from the U. S. Fish commission in 1880. Bulletin, 1882 (1883), vol. II, p. 300. F18–106

[Varieties of German carp.] Bulletin, 1886 (1887), vol. VI, p. 467.

Veckenstedt, Edm.: On the carp ponds of Nether Lusatia. Report, 1878 (1880), p. 671–674. F16–175

Wheeler, L. T.: A new method of protecting the eggs of carp and rearing the young. Bulletin, 1884 (1884), vol. IV, p. 221–222. F18–291

White, C. M.: Ability of carp to endure muddy, slimy, and stagnant water. Bulletin, 1883 (1883), vol. III, p. 444. F18–176

Worth, Stephen G.: The selection of sites and the construction of carp ponds. Bulletin, 1884 (1884), vol. IV, p. 33–37. F13–79

Wright, Abel A.: A Georgia carp pond. Bulletin, 1881 (1882), vol. I, p. 68–69. F18–26

Yoakum, F. L.: Carp culture in Texas. Bulletin, 1882 (1883), vol. II, p. 28–32. F12–343

Yost, John: Report upon the management of German carp by a Mississippi correspondent. Bulletin, 1882 (1893), vol. II, p. 310. F18–108

Zenk, F.: Prices of carp, tench, and goldorfe in Germany. Bulletin, 1833 (1883), vol. III, p. 406. F18–152

Zentz, F.: On the races or varieties of carp, denying the existence of blue carp and gold carp. Bulletin, 1881 (1882), vol. I, p. 387–389.

DALLIIDÆ.

Nelson, Edward William: [The blackfish of Alaska—*Dallia pectoralis* Bean.] *In* The fishery industries of the United States. 1884. Sec. I, pt. III, p. 466–467.

DIODONTIDÆ.

Goode, George Brown: [The porcupine fishes—Diodontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 170.

DOROSOMATIDÆ.

Goode, George Brown: [The mud-shad—*Dorosoma cepedianum*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 610.

ECHENEIDIDÆ.

Goode, George Brown: [The Remora family—Echeneididæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 446–447.

ELOPIDÆ.

Goode, George Brown: [The tarpum—*Megalops thrissoides*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 610–611.

—— [The big-eyed herring—*Elops saurus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 611.

Kenworthy, C. J.: Food qualities of tarpum (Megalops). Bulletin, 1884 (1884), vol. IV, p. 80. F18–230

EMBIOTOCIDÆ.

Eigenmann, Carl H.: [A review of the Embiotocidæ.] Bulletin, 1892 (1894), vol. XII, p. 382–400.

Jordan, David Starr: [The surf-fish family—Embiotocidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 276–279.

ENGRAULIDÆ.

Goode, George Brown: [The anchovies—Engraulidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 611–612.

Swain, Joseph: A review of the species of Stolephorus found on the Atlantic coast of the U. S. Bulletin, 1882 (1883), vol. II, p. 55–57. F12–346

EPHIPPIDÆ.

Goode, George Brown: [The moon-fish—*Chætodipterus faber*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 445–446.

ESOCIDÆ.

Goode, George Brown: [The pike family—Esocidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 461–466.

Kendall, William Converse: The pikes: their geographical distribution, habits, culture, and commercial importance. (Bibliography: p. 42–45.) Appendix V, Report, 1917 (1919), 45 p., illus. *Doc. 853 issued Sept. 27, 1917.* F17–262

Ryder, John Adam: Development of the silver gar (*Belone longirostris*), with observations on the genesis of the blood in embryo fishes, and a comparison of fish ova with those of other vertebrates. Bulletin, 1881 (1882), vol. I, p. 283–301, pl. XIX–XXI. F12–323

Walke, E. H.: Spawning of Esox (pike or pickerel) in North Carolina. Bulletin, 1883 (1883), vol. III, p. 295. F18–139

FIERASFERIDÆ.

Goode, George Brown: [The Fierasfer family—Fierasferidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 243.

GADIDÆ.

On the **Artificial** raising of cod in America. Bulletin, 1883 (1883), vol. III, p. 428.

Atwood, Nathaniel E.: Unexplained variations in the yield of oil from cod livers. Bulletin, 1883 (1883), vol. III, p. 431–432. F18–165

Cobb, John Nathan: Pacific cod fisheries. (Bibliography: p. 108–111.) Appendix IV, Report, 1915 (1917), 111 p. incl. tables, IX pl., fold. chart. *Doc. 830 issued Oct. 23, 1916.* F16–191

The **Codfisheries** on the coast of Norway. Bulletin, 1882 (1883), vol. II, p. 138. F18–91

Collins, Joseph William: Success of the gill-net cod fishery on the New England coast, winter 1882–83. Bulletin, 1883 (1883), vol. III, p. 441–443. F18–173

——— Some observations on the cod gill-net fisheries and on preservatives for nets. Bulletin, 1884 (1884), vol. IV, p. 58–59. F18–220

——— What codfish sometimes swallow. Bulletin, 1884 (1884), vol. IV, p. 175. F18–267

——— Unusual abundance of cod on Brown's Bank. Bulletin, 1885 (1885), vol. V, p. 234. F18–414

——— A curious knife found in the flesh of a codfish. Bulletin, 1886 (1887), vol. VI, p. 381–383. F18–615

Dambeck, Carl: Geographical distribution of the Gadidæ or the cod family, in its relation to fisheries and commerce. Report, 1877 (1879), p. 531–557. F16–108

Dunn, Matthias: Number of eggs in the Gadidæ. Bulletin, 1884 (1884), vol. IV, p. 76. F18–228

Earll, R. Edward: A report on the history and present condition of the shore cod-fisheries of Cape Ann, Mass., together with notes on the natural history and artificial propagation of the species. Report, 1878 (1880), p. 685–740. F11–221

Farlow, William Gibson: On the nature of the peculiar reddening of salted codfish during the summer season. Report, 1878 (1880), p. 969–974. F20–120

Goode, George Brown, and Joseph William Collins: The winter haddock fishery of New England. Bulletin, 1881 (1881), vol. I, p. 226–235. *Doc. 31 issued 1881.* F12–238

——— [The cod—*Gadus morrhua.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 200–223.

——— [The tom cods—*Microgadus tomcod* and *M. proximus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 223.

——— [The haddock—*Melanogrammus aeglefinus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 223–228.

——— [The pollock—*Pollachius carbonarius.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 228–233.

——— [The cusk—*Brosmius brosme.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 233.

Gundersen, H.: Drying codfish at Bordeaux. Bulletin, 1886 (1887), vol. VI, p. 84–86, illus. F18–542

Haskell, E. H.: Second annual appearance of young cod hatched by the United States Fish commission in Gloucester Harbor in the winter of 1879–80. Bulletin, 1882 (1883), vol. II, p. 112. F18–84

Krause, Karl E. H.: Cod and halibut fisheries near the Shumagin Islands. Bulletin, 1881 (1882), vol. I, p. 259–260. F18–47

Leslie, Charles C.: Scarcity of blackfish—Mortality of codfish. Bulletin, 1882 (1883), vol. II, p. 132. F18–90

McDonald, Marshall: Experimental investigations upon cod hatching at Woods Hole, Mass., during the winter of 1880–81. Report, 1881 (1884), p. 1127–1129, illus. F16–347

Martin, Stephen J.: Cod-fishing with gill-nets in Ipswich Bay, Massachusetts. Bulletin, 1881 (1882), vol. I, p. 264. F18–50

Mather, Fred: Notes on cod, shrimp, etc., at Cold Harbor. Bulletin, 1884 (1884), vol. IV, p. 123. F18–242

Mauriac, E.: Cases of poisoning caused by spoiled codfish, and the unnecessary prohibition of the sale of reddened codfish. Report, 1886 (1889), p. 1027–1053. F17–151

Moore, Henry Frank: The burbot: A fresh-water cousin to the cod. 4 p., illus. *Economic Circular 25 issued May 9, 1917.* F17–236

——— The haddock: one of the best salt-water fishes. 8 p., illus. *Economic Circular 47 issued Aug. 18, 1920.* F20–159

Phillips, Barnet: A stray cod up the Hudson. Bulletin, 1883 (1883), vol. III, p. 416. F18–156

Rathbun, Richard: Summary of the fishery investigations conducted in the north Pacific Ocean and Bering Sea from July 1, 1888, to July 1, 1892, by the U. S. Fish commission steamer *Albatross.* Bulletin 1892 (1894), vol. XII, p. 127–201, pl. LI–LV. *Doc. 228 issued Feb. 6, 1894.* F12–163

Rognerud, Carl: Hatching cod in Norway. Bulletin, 1887 (1889), vol. VII, p. 113–119. F18–660

Sars, George Ossian: Report of practical and scientific investigations of the cod fisheries near the Loffoden Islands, made during the years 1864–1869. Report, 1877 (1879), p. 565–611. F16–110

——— Report of practical and scientific investigations of the cod fisheries near the Loffoden Islands, made during the years 1870–1873. Report, 1877 (1879), p. 612–661. F16–111

Smith, Everett: A mammoth cod. Bulletin, 1883 (1883), vol. III, p. 443. F18–175

Tarr, Ralph Stockman: Return to Gloucester Harbor of the young codfish hatched by the U. S. Fish commission. Bulletin, 1884 (1884), vol. IV, p. 57–58. F18–219

Tibbetts, N. V.: Scarcity of cod and haddock on the coast of Maine. Bulletin, 1886 (1887), vol. VI, p. 75–76. F18–537

Trolle, C.: The Iceland cod fisheries in 1883. Report, 1883 (1885), p. 371–382. F17–31

Wilcox, William A.: Reappearance of young cod hatched by the United States Fish commission. Bulletin, 1883 (1883), vol. III, p. 439. F18–170

GASTEROSTEIDÆ.

Goode, George Brown: [The stickleback family—Gasterosteidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 457–458.

Ryder, John Adam: Notes on the development, spinning habits, and structure of the four-spined stickleback, *Apeltes quadracus.* Bulletin, 1881 (1882), vol. I, p. 24–29. F12–331

GERRIDÆ.

Goode, George Brown: [The moharra family—Gerridæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 279.

GOBIIDÆ.

Goode, George Brown: [The gobies—Gobiidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 255.

HEXAGRAMMIDÆ.

Moore, Henry Frank: The sablefish, alias black cod. An introduction to one of the best and richest of American food fishes, with recipes for cooking it [by Mary F. Rausch and J. C. Grant]. 6 p., illus. *Economic Circular 23 issued Mar. 8, 1917.* F17–155

Swan, James Gilchrist: Report on black cod of the north Pacific Ocean. Bulletin 1885 (1885), vol. V, p. 225–234. F18–413

HIPPOCAMPIDÆ.

Goode, George Brown: [The sea-horse family—Hippocampidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III p. 172.

Ryder, John Adam: A contribution to the development and morphology of the Lophobranchiates; (*Hippocampus antiquorum*, the sea-horse). Bulletin, 1881 (1882), vol. I, p. 191–199. F12–320

HYODONTIDÆ.

Goode, George Brown: [The moon-eye family—Hyodontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 612–613.

ICOSTEIDÆ.

Goode, George Brown: [The Icosteus family.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 361.

ISTOPHORIDÆ.

Barnes, William M.: Supposed occurrence of sail-fish, Histiophorus. Bulletin, 1883 (1883), vol. III. p. 423–424 F18–159

LABRIDÆ.

Goode, George Brown: [The tautog or black-fish—*Tautoga onitis*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 268–273.

——— [The chogset or cunner—*Ctenolabrus adspersus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 273–274.

Jenkins, Oliver Peebles: Descriptions of new species of fishes from the Hawaiian Islands, belonging to the families of Labridæ and Scaridæ. Bulletin, 1899 (1901), vol. XIX, p. 45–63, illus. *Doc. 433 issued Aug. 30, 1900.* F12–45

Jordan, David Starr: A review of the labroid fishes of America and Europe. Report, 1887 (1890), 101 p. XI pl. *Doc. 173 issued Aug. 24, 1891.* F11–335

LAMPRIDÆ.

Goode, George Brown: [The opah family—Lamprididæ.] *In* The fisheries and fishery industries of United States. 1884. Sec. I, pt. III, p. 335.

Jordan, David Starr: Note on the occurrence of the opah, *Lampris guttatus*, on the Grand Banks. Bulletin, 1887 (1889), vol. VII, p. 202. F18–668

LOPHIIDÆ.

Goode, George Brown: [The goose fishes—*Lophius piscatorius*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 173–174.

LEPIDOSTEIDÆ (LEPISOSTEIDÆ).

Goode, George Brown: [The gar-pike—Lepidosteidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 663–665.

LEPTOCEPHALIDÆ.

Eigenmann, Carl H.: The egg and development of the conger eel. Bulletin, 1901 (1902), vol. XXI. p. 37–44, illus. *Doc. 476 issued Oct. 2, 1901.* F12–263

Eigenmann, Carl H., and Clarence Hamilton Kennedy: The Leptocephalus of the American eel and other American Leptocephali. Bulletin, 1901 (1902), vol. XXI, p. 81–92, illus. *Doc. 480 issued Mar. 31, 1902.* F12–269

LIPARIDIDÆ.

Goode, George Brown: [The lump-suckers: lump-fish and sea snails.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 253–255.

LOBOTIDÆ.

Goode, George Brown: [The triple-tail or black perch—*Lobotes surinamensis*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 444–445.

LOPHIIDÆ.

Smith, Hugh McCormick: Commercial possibilities of the goosefish: a neglected food. With 10 recipes, prepared by Charles Doucot. 5 p. *Economic Circular 13 issued Dec. 14, 1915.* F14–131

LUTIANIDÆ.

Collins, Joseph William: The red snapper grounds in the Gulf of Mexico. Bulletin, 1885 (1885), vol. V, p. 145–146. F18–393

——— Notes on the red snapper fishery. Based on information gathered from Capt. Silas Latham. Bulletin, 1886 (1887), vol. VI, p. 299–300. F18–598

Goode, George Brown: [The grunts or pig-fishes—Diabasis.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 397–400.

LYCODIDÆ.

Goode, George Brown: [The lycodes family—Lycodidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 247–248.

MACROURIDÆ.

Goode, George, Brown: [The Grenadier family (Macruridæ).] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 244.

Jordan, David Starr, and Edwin Chapin Starks: List of fishes dredged by the steamer *Albatross* off the coast of Japan in the summer of 1900, with descriptions of new species and a review of the Japanese Macrouridæ. Bulletin, 1902 (1904), vol. XXII, p. 577–630, illus., 8 pl. *Doc. 551 issued Aug. 13, 1904.* F12–51

MALACANTHIDÆ.

Bumpus, Hermon Cary: The reappearance of the tilefish. Bulletin, 1898 (1899), vol. XVIII, p. 321–333. *Doc. 416 issued Oct. 30, 1899.* F12–32

Collins, Joseph William: Report upon a cruise made to the tilefish ground in the smack *Josie Reeves*, September, 1882. Bulletin, 1882 (1883), vol. II, p. 301–310. F18–107

——— History of the tilefish. Report, 1882 (1884), p. 237–294. II pl. *Doc. 81 issued Aug. 15, 1884.* F11–268

Goode, George Brown: [The tilefish family—Latilidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 360–361.

Lucas, Frederic Augustus: The osteology and immediate relations of the tilefish, *Lopholatilus chamaeleonticeps.* Bulletin, 1904 (1905), vol. XXIV, p. 81–86, illus. *Doc. 559 issued Feb. 14, 1905.* F12–3

Silvester, Charles Frederick: The blood-vascular system of the tilefish *Lopholatilus chamaeleonticeps.* (Literature: p. 112–114.) Bulletin, 1904 (1905), vol. XXIV, p. 87–114, illus., fold. col. pl. *Doc. 560 issued Feb. 14, 1905.* F12–4

Smith, Hugh McCormick: [Reappearance of the tilefish.] Report, 1897 (1898), p. CXXI.

——— [Reappearance of the tilefish.] Report, 1899 (1900), p. CXXX.

U. S. Bureau of Fisheries: The tilefish: a new deep sea food fish. With 12 recipes for cooking it, by Charles Doucot. 6 p., illus. *Economic Circular 19 issued Sept. 30, 1915.* F15–156

MALTHEIDÆ.

Goode, George Brown: [The devil fishes—Antennariidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 173.

MERLUCCIIDÆ.

Goode, George Brown: [The silver hake and the merluccio.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 240–243.

Nye, Willard: Habits of whiting or frost-fish (*Merlucius bilinearis* Mitch.). Bulletin, 1886 (1887), vol. VI, p. 208. F18–577

MICROSTOMIDÆ.

Goode, George Brown: [The smelt family—Microstomidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 543–547.

MONACANTHIDÆ.

Smith, Hugh McCormick: Notice of a filefish new to the fauna of the United States. Bulletin, 1898 (1899), vol. XVIII, p. 273–278, illus., col. pl. *Doc. 412 issued Nov. 1, 1899.* F12–98

MUGILIDÆ.

Bean, Tarleton Hoffman: Report on the proposed introduction of the Jamaica mountain mullet into the United States. Bulletin, 1888 (1890), vol. VIII, p. 443–451. *Doc. 145 issued Apr. 25, 1891.* F11–326

Goode, George Brown: [The mullets—*Mugil albula* and *Mugil brasiliensis*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 449–456.

Hoxie, Walter: Occurrence of mullet in fresh water. Bulletin, 1884 (1884), vol. IV, p. 80. F18–229

Miller, John F.: Proposed introduction of Hawaiian mullet into the United States. Bulletin, 1884 (1884), vol. IV, p. 141–142. F1–250

Phillips, Barnet: Some notes on the mullet fisheries. Bulletin, 1884 (1884), vol. IV, p. 135–137. F13–89

Ravenel, William de Chastignier: Information bearing upon the artificial propagation of mullet. Bulletin, 1887 (1889), vol. VII, p. 197–202. F18–667

MULLIDÆ.

Goode, George Brown: [The red mullet family—Mullidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 361.

MURÆNIDÆ.

Goode, George Brown: [The morays—Murænidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 629.

MYXINIDÆ.

Goode, George Brown: [The hag-fishes—Myxinidæ.] *In* The fisheries and fishery industries of the United States- 1884. Sec. I, pt. III, p. 681–682.

NOMEIIDÆ.

Eigenmann, Carl H.: Description of a new oceanic fish found off southern New England. Bulletin, 1901 (1902), vol. XXI, p. 35–36. *Doc. 475 issued Oct. 22, 1901.* F12–267

OPHIDIIDÆ.

Goode, George Brown: [The sand cusk family—Ophidiidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 243–244.

ORTHAGORISCIDÆ.

Goode, George Brown: [The ocean sun fishes—Orthagoriscidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 169–170.

OSPHROMENIDÆ.

Gill, Theodore Nicholas: Natural and economical history of the gourami (*Osphromenus goramy*). Report, 1872 and 1873 (1874), 21 p., pl. XXXV-XXXVI. F11-205

Matte, Paul: [Receipt of paradise fish (*Macropodus venustus*) from Germany.] Bulletin, 1885 (1885), vol. V, p. 85.

OSTRACIIDÆ.

Goode, George Brown: [The trunk fishes—Ostraciontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 170.

PARALEPIDÆ.

Goode, George Brown: [The paralepis family—Paralepidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 548.

PERCIDÆ.

Evermann, Barton Warren: Descriptions of two new species of darters from Lake Maxinkuckee, Indiana. Report, 1899 (1900), p. 363–367, pl. 17. *Doc. 428 issued Aug. 20, 1900.* F11–109

Goode, George Brown: [The yellow perch—*Perca americana.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 414–417.

——— [The pike perches.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 417–424.

Jordan, David Starr: [The log perch—*Percina caprodes* (Raf.) Grd.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 417.

Kirsch, Philip H.: Notes on the streams and fishes of Clinton County, Kentucky, with a description of a new darter. Bulletin, 1890 (1892), vol. X, p. 289–292. illus. *Doc. 197 issued Sept. 14, 1892.* F12–131

Moenkhaus, William J.: Description of a new species of darter from Tippecanoe Lake. Bulletin, 1902 (1904), vol. XXII, p. 395–398. illus. *Doc. 530 issued Aug. 8, 1903.* F–1270

Pearse, A. S., and Henrietta Achtenberg: Habits of yellow perch in Wisconsin lakes. (Bibliography: p. 363-366.) Bulletin, 1917-1918 (1921), vol. XXXVI, p. 293–366, illus., pl. LXXXIII. *Doc. 885 issued Aug. 4, 1920.* F20–158

Radcliffe, Lewis, and William W. Welsh: Description of a new darter from Maryland. Bulletin, 1912 (1913), vol. XXXII, p. 29–32, pl. XVIII. *Doc. 773 issued May 24, 1913.* F13–123

Worth, Stephen G.: Observations on the hatching of the yellow perch. Bulletin, 1890 (1892), vol. X, p. 331–334, pl. LXI. *Doc. 201 issued Sept. 24, 1892.* F12–120

PLEURONECTIDÆ.

Alexander, Alvin Burton: Notes on the halibut fishery of the northwest coast in 1895. Bulletin, 1897 (1898), vol. XVII, p. 141–144. *Doc. 359 issued Feb. 8, 1898.* F12–244

——— Preliminary examination of halibut fishing grounds of the Pacific coast. With introductory notes on the halibut fishery, by H. B. Joyce. Report and special papers, 1911 (1913), 56 p. *Doc. 763 issued July 22, 1912.* F12–203

Anthony, Raoul Louis Ferdinand: The cultivation of the turbot. Bulletin, 1908 (1910), vol. XXVIII, p. 859–870, pl. CII–CIII, diagrs. *Doc. 686 issued April, 1910.* 10–35563

Baird, Spencer Fullerton: [Pole-flounder (*Glyptocephalus cynoglossus*) abundant on coast of New England.] Report, 1877 (1879), p. 4*–5*.

Broca, P. de: The halibut fishery of the United States. Report, 1873–74 and 1874–75 (1876), p. 169–171. F16–9

Collins, Joseph William: Notes on the halibut fisheries of 1881–82. Bulletin, 1882 (1883), vol. II, p. 311-316. F12–365

——— On the abundance of halibut near Iceland. Bulletin, 1884 (1884), vol. IV, p. 463–464. F18–362

——— The Icelandic halibut fishery. An account of the voyages of three Gloucester schooners to the fishing grounds near the north coast of Iceland. Report, 1884 (1885), p. 289–300, incl. tables. F17–128

Goode, George Brown: [The plaice - *Paralichthys dentatus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 178–182.

——— The bastard halibut—*Paralichthys maculosus* Girard.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 182.

Goode, George Brown: [The halibut—*Hippoglossus vulgaris*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 189–197.

——— [The sand dab or rough dab—*Hippoglossoides platessoides*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 197.

——— [The Greenland turbot—*Platysomatichthys hippoglossoides*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 197–198.

——— [The pole flounder or craig flounder—*Glyptocephalus cynoglossus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 198–199.

——— [The spotted sand flounder—*Lophopsetta maculata*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 199.

Jordan, David Starr: [The flat fishes and soles of the Pacific coast.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 184–189.

——— A review of the flounders and soles (Pleuronectidæ) of America and Europe. Report, 1886 (1889), p. 225–342, IX pl. *Doc. 126 issued 1889.* F15–47

Kendall, William Converse: Notes on a new species of flatfish from off the coast of New England. Bulletin, 1910 (1912), vol. XXX, p. 389–394, pl. LVII. *Doc. 764 issued Aug. 8, 1912.* F12–275

Krause, K. E. H.: A hybrid plaice, *Platessa vulgaris* with *Rhombus maximus*. Bulletin, 1882 (1883), vol. II, p. 341–342. F12–368

Kuntz, Albert: The histological basis of adaptive shades and colors in the flounder, *Paralichthys albiguttus*. (Bibliography, p. 26–28.) Bulletin, 1915–1916 (1918), vol. XXXVI, 29 p., illus., 2 col. pl. *Doc. 842 issued May 28, 1917.* F17–185

Mast, Samuel Ottmar: Changes in shade, color, and pattern in fishes, and their bearing on the problem of adaptation and behavior, with special reference to the flounders Paralichthys and Ancylopsetta. (Bibliography: p. 230–232.) Bulletin, 1914 (1916), vol. XXXIV, p. 173–238, illus., pl. XIX–XXXVII (part col.). *Doc. 821 issued Apr. 10, 1916.* F16–80

Mather, Fred: The experiment of transporting turbot and soles from England to America. Report, 1877 (1879), p. 867–873. F16–123

Scudder, Newton Pratt: The halibut fishery—Davis' Strait. Report, 1880 (1883), p. 189–228. *Doc. 43 issued Apr. 26, 1882.* F11–217

Thorsteinson, Arni Bjarnason: American halibut fisheries near Iceland. Bulletin, 1885 (1885), vol. V, p. 429–433. F18–496

POECILIIDÆ.

Goode, George Brown: [The mummichog family—Poeciliidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 466.

Hildebrand, Samuel Frederick: Notes on the life history of the minnows *Gambusia affinis* and *Cyprinodon variegatus*. (Bibliography: p. 15.) Appendix VI, Report, 1917 (1919), 15 p. *Doc. 857 issued Aug. 13, 1917.* F17–250

Kuntz, Albert: Notes on the habits, morphology of the reproductive organs, and embryology of the viviparous fish *Gambusia affinis*. Bulletin, 1913 (1914), vol. XXXIII, p. 177–190, pl. XVI–XIX. *Doc. 806 issued Oct. 28, 1914.* F14–106

POLYODONTIDÆ.

Goode, George Brown: [The paddle fishes—Polyodontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 660.

POLYNEMIDÆ.

Goode, George Brown: [The thread fish family—Polynemidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 279.

POMACENTRIDÆ.

Goode, George Brown: [The demoiselle and the cichlid families.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p.275–276.

POMATOMIDÆ.

Baird, Spencer Fullerton: Natural history of some of the more important food fishes of the South Shore of New England (bluefish). Report, 1871–72 (1873), p. 235–252. F15–100

Goode, George Brown: [The bluefish family—Pomatomidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 433–444.

Pierce, H. D.: The spawning of bluefish—An opinion of the cause of mortality of fish in the Gulf of Mexico. Bulletin, 1883 (1883), vol. III, p. 332. F18-143

PRISTIPOMATIDÆ.

Goode, George Brown: [The snapper family—Pristipomatidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 395.

RACHYCENTRIDÆ.

Goode, George Brown: [The cobia or crab-eater—*Elacate Canada*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 444.

SALMONIDÆ.

Abernethy, A. S.: Salmon in the Clackamas River. Bulletin, 1886 (1887), vol. VI, p. 332. F18-603

Adams, Andrew Leith: The lake trouts. Report, 1872 and 1873 (1874), p. 357-362. F15-104

Anderson, John: Notes on the biology of the salmon and grilse. Bulletin, 1883 (1883), vol. III, p. 429-430. F18-162

——— [Salmon and trout in Scotland.] Bulletin, 1885 (1885), vol. V, p. 468.

Atkins, Charles G.: On the salmon of eastern North America, and its artificial culture. Report, 1872 and 1873 (1874), p. 226-337. F15-99

——— Memoranda relative to inclosures for the confinement of salmon, drawn from experience at Bucksport, Penobscot River, Maine. Bulletin, 1884 (1884), vol. IV, p. 170-174. F13-92

——— Memoranda on landlocked salmon. Bulletin, 1884 (1884), vol. IV, p. 341-344. F13-112

——— Ten questions concerning the habits and breeding of landlocked salmon, with replies. Bulletin, 1884 (1884), vol. IV, p. 383-384. F18-341

——— The Atlantic and landlocked salmons. Report, 1897 (1898), p. 27-70.

Atwater, Wilbur Olin: Report of analysis of a sample of fish guano made from salmon offal, by Mr. Joseph Spratt, of Victoria, British Columbia. Bulletin, 1884 (1884), vol. IV, p. 238. F13-103

Barber, C. H.: Success in raising landlocked salmon. Bulletin, 1884 (1884), vol. IV, p. 87. F18-233

Barfurth, D.: The food and manner of living of the salmon, the trout, and the shad. (Prefatory note by Theo. Gill: p. 735-736.) Report, 1873-74 and 1874-75 (1876), p. 735-759.

Barin, L. T.: Salmon in the Clackamas River. Bulletin, 1886 (1887), vol. VI, p. 111-112. F18-552

Bean, Tarleton Hoffman: Notes on a shipment, by the United States Fish commission of California salmon (*Oncorhynchus chouicha*) to Tanners Creek, Indiana, in 1876. Bulletin, 1881 (1882), vol. I. p. 204-205. F18-38

——— Account of a shipment, by the United States Fish commission, of California salmon-fry (*Oncorhyncus chouicha*) to southern Louisiana, with note on some collections made at Tickfaw. Bulletin, 1881 (1882), vol. I, p. 205-206. F18-39

——— Brook trout from Monadnock Lake and Cristine Lake, New Hampshire. Bulletin, 1884 (1884), vol. IV, p. 293-294. F13-107

——— [Natural history of the salmon.] Bulletin, 1889 (1891), vol. IX, p. 189-200.

——— [Life history of the salmon.] Bulletin, 1892 (1894), vol. XII, p. 21-38, pl. II-IX.

Behr, Friedrich von: Five American Salmonidae in Germany. Bulletin, 1882 (1883), vol. II, p. 237-246. F12-360

Benecke, Berthold Adolf: Observations on salmon in German rivers Bulletin, 1886 (1887), vol. VI, p. 119-122 incl. tab. F18-556

Bottemanne, C. J.: California salmon in the Netherlands. Report, 1879 (1882), p. 709-713. F17-20

——— Penning of salmon in order to secure their eggs. Bulletin, 1884 (1884), vol. IV, p. 169 F18-265

Bower, Seymour: Instructions for taking whitefish eggs. Bulletin, 1884 (1884), vol. IV, p. 113-114. F18-239

Brice, J. J.: Establishment of stations for the propagation of salmon on the Pacific coast. Report, 1893 (1895), p. 387-392. 12-17363

Buck, H. H.: Report upon hatching one million whitefish eggs from the Great Lakes, at Orland, Me., and upon planting the young in Eagle Lake, Mount Desert. Bulletin, 1883 (1883), vol. III, p. 454–455. F18–182

Chamberlain, F. M.: Some observations on salmon and trout in Alaska Report and special papers, 1906 (1908), 112 p., pl., fold. map., diagrs. *Doc. 627 issued Dec. 18, 1907.* 7–35437

Cheney, A. Nelson: The Hudson River as a salmon stream. Bulletin, 1897 (1898), vol. XVII, p. 247–251. *Doc. 376 issued Aug. 8, 1898.* F12–110

——— Salmon in the Hudson River. Bulletin, 1886 (1887), vol. VI, p. 351-352. F18–610

Clark, Frank N.: On the rearing of the whitefish in spring-water and its relation to their subsequent distribution. Bulletin, 1881 (1882), vol. I, p. 301-306. F20-116

——— Report of operations connected with the propagation of whitefish (*Coregonus albus*) at the Northville station, Northville, Michigan, for season of 1880-81. Report, 1880 (1883), p. 553–596. F16–276

——— Spawning of California mountain trout, reared in confinement, from eggs brought from McCloud River. Bulletin, 1883 (1883), vol. III, p. 256. F18-130

——— On the propriety of depositing whitefish minnows off the harbor of Cleveland, Ohio. Bulletin, 1883 (1883), vol. III, p. 349–352. F12–398

——— Results of planting young whitefish in Lake Erie. What the fishermen think of whitefish propagation. Bulletin, 1885 (1885), vol. V, p. 113-120 F18-382

——— Natural as compared with artificial hatching of whitefish. Bulletin, 1885 (1885), vol. V, p. 321–323. F18–465

——— History and methods of whitefish culture. Bulletin, 1893 (1894), vol. XIII, p. 213–220. *Doc. 257 issued 1894.* F12-183

Clarke, H. R.: Propagation of trout by the Southside club. Bulletin, 1885 (1885), vol. V, p. 436. F18–500

Cobb, John Nathan: The salmon fisheries of the Pacific coast. Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

——— Pacific salmon fisheries. Appendix III, Report, 1916 (1917), 255 p. incl. tables, XXIX pl. *Doc. 839 issued June 9, 1917.* F17–238

Collins, John D.: Propagation of salmon in Salmon River, Oswego County, New York. Bulletin, 1885 (1885), vol. V, p. 287–289. F18–442

Correspondence connected with the transmission of eggs of the Quinnat salmon and whitefish to Australia and New Zealand, 1877, 1878, and prior years. Report, 1878 (1880), p. 825–905. F16–185

Correspondence connected with the transmission of eggs of the Quinnat salmon and other Salmonidæ to European countries in 1878 and prior years. Report, 1878 (1880), p. 907–924. F16–186

Dannevig, Gunder Mathisen: Salmonidæ in Australia. (From his report on the London fisheries exhibition.) Bulletin, 1885 (1885), vol. V, p. 440–442. F18–512

Day, Francis: On the rearing, growth, and breeding of salmon in fresh water in Great Britain. Bulletin, 1885 (1885), vol. V, p. 307–308. F18–452

——— Experiments with salmon in Scotland. Bulletin, 1886 (1887), vol. VI, p. 56. F18–532

Dowell, Benjamin Franklin: Efforts in trout culture. Bulletin, 1884 (1884), vol. IV, p. 64. F18–224

——— Cultivation trout in Oregon. Bulletin, 1884 (1884), vol. IV, p. 217. F18–286

Downing, Seth W.: A plan for promoting the whitefish production of the Great Lakes. Bulletin, 1908 (1910), vol. XXVIII, p. 627–633. *Doc. 672 issued Apr. 14, 1910.* 10–35439

Duncan, J. Barker: Salmon and trout hatcheries in Scotland. Bulletin, 1885 (1885), vol. V, p. 451–456. F18–508

Dunn, Horace D.: Do the spawning salmon ascending the Sacramento River all die without returning to sea? With notes by Livingston Stone. Report, 1878 (1880), p. 815–818. F16–183

Evermann, Barton Warren: A preliminary report upon salmon investigations in Idaho in 1894. Bulletin, 1895 (1896), vol. XV, p. 253–284. *Doc. 301 issued Feb. 20, 1896.* F12–245

——— A report upon salmon investigations in the headwaters of the Columbia River, in the State of Idaho, in 1895: together with notes upon the fishes observed in that State in 1894 and 1896. Bulletin, 1896 (1897), vol. XVI, p. 149–202, pl. 67–72 (partly fold.). *Doc. 318 issued Nov. 17, 1896.* F11–343

Evermann, Barton Warren: The golden trout of the southern high Sierras. (Bibliography: p. 50–51.) [Contains also: "Temperature conditions in the Kern River region, by O. P. Jenkins": p. 39. "The food of the trout of the Kern River region, by Chancey Juday:" p. 43.] Bulletin, 1905 (1906), vol. XXV, p. 3–51 XVII pl. (partly col), fold. map. *Doc. 595 issued May 19, 1906.* F11–66

Evermann, Barton Warren, and Edmond Lee Goldsborough: The fishes of Alaska. (Bibliography: p. 358–360.) Bulletin, 1906 (1907), vol. XXVI, p. 219–360, illus., pls. (partly col.). *Doc. 624 issued Dec. 6, 1907.* 7–35452

Evermann, Barton Warren, and Seth Eugene Meek: A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific coast in 1896. Bulletin, 1897 (1898), vol. XVII, p. 15–84, illus., 2 pl. *Doc. 352 issued Jan. 6, 1898.* F12–241

Evermann, Barton Warren, and Hugh McCormick Smith: The whitefishes of North America. Report, 1894 (1896), p. 283–324, illus., pl. 11–28. *Doc. 323 issued Nov. 27, 1896.* F11–189

Farr, S. C.: Description of a California salmon (Oncorhyncus sp.) found in one of the rivers of New Zealand and identified by Dr. T. N. Bean. Bulletin, 1883 (1883), vol. III, p. 427 F18–161

Fiedler, Judge: The migration of salmon (*Salmo salar* L.) in the Baltic. Bulletin, 1885 (1885), vol. V, p. 185–188. F18–401

Finley, Charles I.: Shad in Oregon waters—a new salmon hatchery. Bulletin, 1884 (1884), vol. IV, p. 88. F18–236

——— Further report of R. D. Hume's salmon hatchery, Oregon. Bulletin, 1884 (1884), vol. IV, p. 174. F18–266

Fisher, William J.: Statement of the catch of the several companies engaged in the salmon fisheries in Kadiak district, Alaska Territory, during the year 1883. Bulletin, 1884 (1884), vol. IV, p. 134. F18–247

Forbes, Stephen Alfred: The food of young whitefish—*Coregonus clupeiformis.* Bulletin, 1881 (1882), vol. I, p. 19–20. F18–8

——— The first food of the common whitefish (*Coregonus clupeiformis* Mitch.). Report, 1881 (1884), p. 771–782. F16–339

Frey, E.: Disposition of whitefish eggs sent to Switzerland. Bulletin, 1885 (1885), vol. V, p. 358. F18–474

Gaylord, Harvey Russell, and **Millard Caleb Marsh:** Carcinoma of the thyroid in the salmonoid fishes (Bibliography: p. 519–524.) Bulletin, 1912 (1913), vol. XXXII, p. 363–524, illus., pl. LVI–CX (part col.). *Doc. 790 issued Apr. 22, 1914.* F14–37

Geare, Randolph I.: [The Lake whitefish—*Coregonus clupeiformis.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 507–540.

Gilbert, Charles Henry: Age at maturity of the Pacific coast salmon of the genus *Oncorhynchus.* Bulletin, 1912 (1913), vol. XXXII, p. 1–22, pl. I–XVII. *Doc. 767 issued Mar. 20, 1913.* F13–70

Gilbert, W. L.: Growth of the sabling (*Salmo salvelinus*) in the Old Colony trout ponds at Plymouth, Massachusetts. Bulletin, 1881 (1882), vol. I, p. 427. F 8–57

Glen Falls Republican: [Salmon, lake trout, and brown trout at Glen Falls.] Bulletin, 1886 (1887), vol. VI, p.133.

Goll, Hermann: The American brook trout recommended for Swiss waters Bulletin, 1886 (1887), vol. VI, p. 206–208. F18–576

Goode, George Brown: [The salmon—*Salmo salar.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 468–474.

——— [The salmons of the Pacific.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 474–479.

——— [The namaycush or lake trout—*Salvelinus namaycush.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. 485–497.

——— [The speckled trout—*Salvelinus fontinalis.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 497–500.

——— [The saibling, or Bavarian char—*Salvelinus alpinus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 500–504.

Green, Loren W.: Condition of the United States trout ponds. Bulletin, 1885 (1885), vol. V, p. 309. F18–454

——— On a disease affecting the rainbow trout at McCloud River station. Bulletin, 1885 (1885), vol. V, p. 472. F18–513

——— [Salmon and trout at the McCloud River station.] Bulletin, 1886 (1887), vol. VI, p. 314.

——— Salmon in the McCloud River during the season of 1886. Bulletin, 1886 (1887), vol. VI, p. 334–336. F18–605

Green, Seth: Rearing of California mountain trout (*Salmo irideus*). Bulletin, 1881 (1882), vol. I, p. 23. F18–11

——— Salmon caught in Genesee River, New York. Bulletin, 1881 (1882), vol. I, p. 23–24. F18–12

——— The introduction of land-locked salmon into Woodhull Lake, New York, and the subsequent capture of some of them. Bulletin, 1881 (1882), vol. I, p. 421. F18–55

Greene, Charles Wilson: Physiological studies of the Chinook salmon. Bulletin, 1904 (1905), vol. XXIV, p. 429–456 incl. tables, illus. *Doc. 584 issued Nov. 2, 1902.* F12–13

——— The migration of salmon in the Columbia River. Bulletin, 1909 (1911), vol. XXIX, p. 129–148, pl. XXVI–XXVII. *Doc. 743 issued Mar. 15, 1911.* F11–102

——— Anatomy and histology of the alimentary tract of the king salmon. Bulletin, 1912 (1913), vol. XXXII, p. 73–100, pl. XXV–XXVIII. *Doc. 777 issued* July *25, 1913.* F15–20

——— The storage of fat in the muscular tissue of the king salmon and its resorption during the fast of the spawning migration. Bulletin, 1913 (1914), vol. XXXIII, p. 69–138, pl. III–XI. *Doc. 799 issued Sept. 30, 1914.* F14–100

——— The fat-absorbing function of the alimentary tract of the king salmon. Bulletin, 1913 (1914), vol. XXXIII, p. 149–175, pl. XII–XV. *Doc. 802 issued Oct. 28, 1914.* F14–104

Greene, Charles Wilson, and Carl Hartly Greene: The skeletal musculature of the king salmon. Bulletin, 1913 (1914), vol. XXXIII, p. 21–59, illus., II pl. *Doc. 796 issued Aug. 8, 1914.* F14–113

Greenfield, Alfred: Report upon the receipt and hatching of American whitefish ova and planting of the fry in Australia. Bulletin, 1884 (1884), vol. IV, p. 190–191. F18–279

Haack, Hermann: Raising salmonoids in inclosed waters. Report, 1879 (1882), p. 675–685. F17–18

——— Treatment of young salmonoids and coregoni from the time they leave the egg till they are fully developed and can be placed in open waters. Report, 1879 (1882), p. 687–693. F17–19

Habersham, William Ney A.: Note on the use of the male salmon hook and the run of 1883. Bulletin, 1884 (1884), vol. IV, p. 52. F18–215

Hamlin, Augustus Choate: On the salmon of Maine. Report, 1872–73 (1874), p. 338–356. F15–103

Hessel, Rudolph: The salmon of the Danube, or the hucho (*Salmo hucho*), and its introduction into American waters. Report, 1872 and 1873 (1874), p. 161–165. F15–94

Hodge, E. B.: Culture of the landlocked and Penobscot salmon in New Hampshire. Bulletin, 1885 (1885), vol. V, p. 423–424. F18–490

Holberton, Wakeman: The successful stocking of streams with trout. Bulletin, 1883 (1883), vol. III, p. 192. F18–123

Holden, E. C.: The Columbia River salmon—a hatchery needed. Bulletin, 1884 (1884), vol. IV, p. 304. F18–321

Huske, C. J.: Report on California trout distribution in South Carolina in 1889. Bulletin, 1884 (1884), vol. IV, p. 164–165. F18–259a

Jerrell, H. P.: Concerning the salmon fisheries of Bretagne, France, and the need of fish-ways and restrictive legislation. Bulletin, 1884 (1884), vol. IV, p. 185–186. F18–276

Jordan, David Starr: [The Dolly Varden trout—*Salvelinus malma*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 504–505.

——— [The lesser whitefishes.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 541–543.

——— The mountain or salmon trout of Oregon. Bulletin, 1885 (1885), vol. V, p. 310. F18–456

Jordan, David Starr, and Barton Warren Evermann: A review of the salmonoid fishes of the Great Lakes, with notes on the whitefishes of other regions. Bulletin, 1909 (1911), vol. XXIX, p. 1–41, illus., col. pl. I–VII. *Doc. 737 issued Feb. 7, 1911.* F11–39

Juday, Chancey: Notes on Lake Tahoe, its trout and trout-fishing. (Literature cited: p. 146.) Bulletin, 1906 (1907), vol. XVI, p. 133–146. *Doc.* 615 *issued May 11, 1907.* F11–63

——— A study of Twin Lakes, Colorado, with especial consideration of the food of the trouts. (Bibliography: p. 175–178.) Bulletin, 1906 (1907), vol. XXVI, p. 147–178, pl. III. *Doc. 616 issued May 24, 1907.* F11–64

Kendall, William Converse: [Salmon of Sebago Lake.] Report, 1899 (1900), p. CXXI–CXXIII.

——— [The whitefishes of Maine.] Bulletin, 1902 (1904), vol. XXII, p. 363–368, illus.

——— Fishes and fishing in Sunapee Lake. Report and special papers, 1912 (1914), 96 p., illus., IX pl. *Doc. 783 issued Jan. 28, 1914.* F14–1

——— The Rangeley Lakes, Maine: With special reference to the habits of the fishes, fish-culture, and angling. Bulletin, 1915–1916 (1918), vol. XXXV, p. 487–594, illus., pl. XI–XLVI (part. col.). *Doc. 861 issued May 25, 1918.* F18–682

Kendall, William Converse, and E. L. Goldsborough: The fishes of Connecticut Lakes and neighboring waters, with notes on the plankton environment. Report and special papers, 1907 (1909), 77 p., illus., X pl., 2 charts. *Doc. 633 issued July 6, 1908.* 8–35558

Koss, R. A.: Trout and trout culture. Bulletin, 1883 (1883), vol. III, p. 473–476. F12–389

Kunnel: On the conditions under which trout exist in the German waters. Bulletin, 1884 (1884), vol. IV, p. 393–395. F18–348

Lanman, Charles: The Salmonidæ of eastern Maine, New Brunswick, and Nova Scotia. Report, 1872–73 (1874), p. 219–225. F15–98

Loomis, Watts T.: A landlocked salmon caught in the Erie canal. Bulletin, 1884 (1884), vol. IV, p. 288. F18–312

McDonald, Marshall: California trout planted in Roanoke River in July, 1883, retaken in June, 1884. Bulletin, 1884 (1884), vol. IV, p. 286. F18–311

——— Report on the salmon fisheries of Alaska. (Life history of the salmon by T. H. Bean: p. 21.) (Bibliography of the Salmonidæ of Alaska and adjacent regions, by T. H. Bean: p. 39.) Bulletin, 1892 (1893), vol. XII, 49 p. IX pl. *Doc. 200 issued July 27, 1892.* F12–119

——— [Species of Alaska salmon of economic value.] Bulletin, 1892 (1894), vol. XII, p. 12–13.

——— The salmon fisheries of the Columbia River basin . . . together with a report upon physical and natural-history investigations in the region by C. H. Gilbert and W. B. Evermann. Bulletin, 1894 (1895), vol. XIV, p. 153–207, pl. 13–25 (partly fold.). *Doc. 290 issued Aug. 27, 1894.* F12–174

Maitland, Sir James Ramsey Gibson: Exchange of land-locked salmon eggs from Maine for Loch Leven trout ova from Scotland. Bulletin, 1884 (1884), vol. IV, p. 114. F18–240

Malmgren, Anders John: The migrations of the salmon (*Salmo salar L.*) in the Baltic. Bulletin, 1884 (1884), vol. IV, p. 322–328, illus. F13–110

Maslieurat-Lagemard: Acclimatization of *Salmo quinnat* in France. Bulletin, 1884 (1884), vol. IV, p. 144. F18–255

Mason, Frank Holcomb: Proposed exportation of white fish eggs to Switzerland. Bulletin, 1883 (1883), vol. III, p. 272. F18–131

Mather, Fred: Brown trout in America. Bulletin, 1887 (1889), vol. VII, p. 21–22. F18–640

——— Report upon the result of salmon planting in the Hudson River. Bulletin, 1887 (1889), vol. VII, p. 409–424. F18–678

Maynard, H. J.: Rainbow trout in southwestern Missouri. Bulletin, 1887 (1889), vol. VII, p. 55–56. F18–647

Metcalf, Martin: Success in propagating California mountain trout from eggs brought to Michigan by the United States Fish commission. Bulletin, 1883 (1883), vol. III, p. 471–472. F18–197

Miescher-Rusch, F.: Contribution to the biology of the Rhine salmon. (Reprint from the Swiss literary contributions to the International fishery exposition at Berlin, 1880.) Report, 1880 (1883), p. 427–474, tables. F16–292

Milner, James W.: Notes on the grayling of North America, and descriptions of new species of Coregonus and Argyrosomus. Report, 1872–73 (1874), 20 p. F11–206

Moores, I. R.: [The rocky mountain whitefish (*Coregonus williamsoni.*)] Bulletin, 1884 (1884), vol. IV, p. 315.

Morgan, George: Capture of land-locked salmon at Oswego, New York. Bulletin, 1882 (1883), vol. II, p. 15. F18–56

Moser, Jefferson F.: The salmon fisheries of Alaska. Report of the operations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1898. Bulletin, 1898 (1899), vol. XVIII, 178 p., VI pl., illus., fold. charts, 63 pl. *Doc. 408 issued July 27, 1899.* F12–94

——— The salmon and salmon fisheries of Alaska. Report of the Alaska salmon investigations of the U. S. Fish commission steamer *Albatross* in 1900 and 1901. Bulletin, 1901 (1902), vol. XXI, p. 173–398, 399*–401*, illus., fold. tables and charts, XLIV pl. *Doc. 510 issued Oct. 31. 1902.* F12–278

Murray, C. H.: Young trout destroyed by mosquitoes. Bulletin, 1885 (1885), vol. V, p. 243–244. F18–417

O'Malley, Henry: Artificial propagation of the salmons of the Pacific coast. Revised and enlarged. Appendix II, Report, 1919 (1921), 32 p., illus., IX pl. *Doc. 879 issued Jan. 8, 1920.* F20–153

O'Malley, Henry, and Willis H. Rich: Migration of adult sockeye salmon in Puget Sound and Fraser River. Appendix VIII, Report, 1918 (1920), 38 p. incl. tables, pl., fold. chart. *Doc. 873 issued Dec. 3, 1919.* F 19–43

Page, William F.: Feeding and rearing fishes, particularly trout, under domestication. Bulletin, 1894 (1895), vol. XIV, p. 289–314. *Doc. 294 issued May 22, 1895.* 12–17377

——— Shrinkage of whitefish eggs during transportation on trays. Bulletin 1886 (1887), vol. VI, p. 360. F18–612

Paige, Charles L.: A method of cultivating rainbow trout and other salmonoids. Bulletin 1908 (1910), vol. XXVIII, p. 781–787, diagrs. *Doc. 677 issued April, 1910.* 10–35421

——— The comparative value of foods for rainbow trout and other salmonoids. Bulletin, 1908 (1910), vol. XXVIII, p. 795–798. *Doc. 679 issued April, 1910.* 10–35419

Pratt, K. B.: Report of salmon-hatching operations on Rogue River, Oregon, 1877–78. Report, 1878 (1880), p. 773–774. F16–180

Raveret-Wattel and Bartet: Reproduction of California salmon in the aquarium of Trocadero. Bulletin, 1883 (1883), vol. III, p. 207–208. F12–382

——— Note on the culture of American salmon in France. Bulletin, 1885 (1885), vol. V, p. 260. F18–428

Redmond, Roland: On rainbow trout reared from eggs brought from California. Bulletin, 1883 (1883), vol. III, p. 230. F18–127

Rich, Willis H.: Early history and seaward migration of chinook salmon in the Columbia and Sacramento Rivers. (Bibliography: p. 71–72.) Bulletin, 1919–20 (192–), vol. XXXVII, 73 p., illus., IV pl. *Doc. 887 issued July 26, 1920.* F20–155

Robinson, W. Russel: A California salmon taken in James River. Bulletin, 1884 (1884), vol. IV, p. 290. F18–314

Rosenberg, Albert: Experience in abating disease among brook trout. Bulletin, 1908 (1910), vol. XXVIII, p. 914–945. *Doc. 694 issued April, 1910.* 10–35415

Rutter, Cloudsley: Natural history of the quinnat salmon. A report on investigations in the Sacramento River, 1896–1901. Bulletin, 1902 (1904), vol. XXII, p. 65–141 incl. tables, illus., pl. 10–18 (partly fold.). *Doc. 515 issued Mar. 30, 1903.* F12–59

Ryder, John Adam: On the nuclear cleavage-figures developed during the segmentation of the germinal disk of the eggs of the salmon. (List of papers: p. 335.) Bulletin, 1881 (1882), vol. I, p. 335–339, pl. XVIII. F12–324

Seagle, George A.: The artificial propagation of the rainbow trout. Bulletin, 1896 (1897), vol. XVI, p. 239–256, illus., pl. 88–94. *Doc. 319 issued Nov. 17, 1896.* F12–111

Sekizawa, Akekio: Memorandum on fish culture in Japan, with notice of experiments in breeding the California trout. Report, 1879 (1882), p. 645–648. F17–12

Simms, George E.: An improvement in hatching and rearing boxes; with notes on the continuous feeding of the fry of Salmonidæ. Bulletin, 1908 (1910), vol. XXVIII, p. 1015–1023. *Doc. 704 issued Apr., 1910.* 10–35441

Smith, E. L.: Hood River, Oregon, as a place for salmon breeding. Bulletin, 1886 (1887), vol. VI, p. 87–88. F18–543

Smith, Hugh McCormick: Notes on two hitherto unrecognized species of American whitefishes. Bulletin, 1894 (1895), vol. XIV, p. 1–13. *Doc. 232 issued Mar. 19, 1894.* F12–177

——— Notes on the capture of Atlantic salmon at sea and in the coast waters of the eastern States. Bulletin, 1894 (1895), vol. XIV, p. 95–99, pl. 3–4. *Doc. 281 issued May 4, 1894.* F12–168

——— The salmon fishery of Penobscot Bay and River in 1895 and 1896. Bulletin, 1897 (1898), vol. XVII, p. 113–124, illus., pl. 5. *Doc. 357 issued 1898.* F12–407

Smith, Silas B.: Efforts to raise trout. Bulletin, 1885 (1885), vol. V, p. 435–436. F18–499

Snyder, John Otterbein: A new species of trout *(Salmo regalis)* from Lake Tahoe. Bulletin, 1912 (1914), vol. XXXII, p. 23–28. *Doc. 768 issued Dec. 31, 1912.* F13–12

——— Three new whitefishes from Bear Lake, Idaho and Utah. Bulletin, 1917–18 (1921), vol. XXXVI, 7 p., illus. *Doc. 864 issued May 7, 1919.* F19–35

Some results of the artificial propagation of Maine and California salmon in New England and Canada, recorded in the years 1879 and 1880. Bulletin, 1881 (1882), vol. I, p. 270–277. F20–142

Sterling, E.: On the impropriety of depositing whitefish minnows off the harbor of Cleveland, Ohio. Fishing for saugers. Bulletin, 1883 (1883), vol. III, p. 302–303. F18–141

Stirling, A. B.: Notes on the fungus diseases affecting salmon. Report, 1878 (1880), p. 525–529. F16–167

Stone, Livingston: Notes on the salmon of the Miramichi River. Report, 1871 and 1872 (1873), p. 216–218. F15–97

——— The salmon fisheries of the Columbia River. (Varieties of salmon: p. 815–820.) Report, 1875–76 (1878), p. 801–823. F6–70

——— Replies to questions of Herr von Behr concerning *Salvelinus fontinalis* and *Salmo irideus*. Bulletin, 1882 (1883), vol. II, p. 9–12. F18–61

——— [The quinnat, or California salmon—*Oncorhynchus chouicha*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 479–485.

——— Explorations on the Columbia River from the head of Clarks Fork to the Pacific Ocean made in the summer of 1883, with reference to the selection of a sutiable place for establishing a salmon-breeding station. Report, 1883 (1885), p. 237–258. F11–241

——— The artificial propagation of salmon on the Pacific coast of the United States, with notes on the natural history of the quinnat salmon. Bulletin, 1896 (1897), vol. XVI, p. 203–235, pl. 73–87. *Doc. 320 issued Nov. 7, 1896.* F12–113

Stranahan, J. J.: The methods, limitations, and results of whitefish culture in Lake Erie. Bulletin, 1897 (1898), vol. XVII, p. 315–319. *Doc. 386 issued 1898.* F12–110

Suckley, George: On the North American species of salmon and trout. Report, 1872 and 1873 (1874), p. 91–160. F15–93

Trybom, Filip, i. e. Arvid Filip: Salmon fisheries of Halland, Sweden, especially in the River Viskan. Bulletin, 1886 (1887), vol. VI, p. 104–105. F18–549

U. S. Bureau of Fisheries: Miscellaneous notes and correspondence relative to the whitefish. A. The whitefish of the Great Lakes [letters from George Barnston, John W. Kerr, Peter Kiel]. B. The whitefish of eastern Maine and New Brunswick, by Charles Lanman. C. New species of Argyrosomus and Coregonus, by James W. Milner. Report, 1872 and 1873 (1874), p. 79–89. F15–92

——— Miscellaneous notes and correspondence relative to salmon and trout. A. On the salmon in Maine, by Thomas Lincoln. B. On the stomachs of salmon and their contents, by James K. Thatcher and Sidney I. Smith. C. On the silver-trout of Monadnock Lake, New Hampshire, by Thos. E. Hatch. D. On the edible qualities of the Sacramento salmon, by S. R. Throckmorton. E. On the salmon fisheries of the Sacramento River, by Livingston Stone. Report, 1872 and 1873 (1874), p. 369–379. F15–106

——— Additional reports relative to the hatching and planting of the Penobscot salmon. By Wm. W. Fletcher, J. H. Slack, Thaddeus Norris, E. Sterling, and H. F. Dousman. Report, 1872 and 1873 (1874), p. 380–384. F15–107

——— Hatching and distribution of California salmon. A. Report on California salmon spawn hatched and distributed, by J. H. Slack. B. Hatching and distribution of California salmon in tributaries of Great Salt Lake, by A. P. Rockwood. Report, 1873–74 and 1874–75 (1876), p. [431]–435. F16–22

——— Correspondence relating to the San Joaquin River and its fishes. [From B. B. Redding and Walter Nethercleft.] Report, 1873–74 and 1874–75 (1876), p. [479]–483. F16–24

——— Artificial propagation of the lake trout, grayling, and whitefish . . . (Extracted from the rev. ed. of the Manual of Fish culture.) p. 91–120, pls. (1 fold.). *Doc. 520 issued Apr. 6, 1903.* 8–35705

——— Canned salmon: cheaper than meats, and why. Including fifty tested recipes. 11 p. *Economic Circular 11 issued Mar. 7, 1914.* F14–35

Valery-Mayet: Acclimatization of *Salmo quinnat* in France. Bulletin, 1884 (1884), vol IV, p. 138. F18–247b

——— Hatching salmon eggs at Montpellier, France, and trouble with fungus. Bulletin, 1885 (1885), vol. V, p. 272. F18–434

Vincent, Eugene: Causes of disease in young salmonoids. Bulletin, 1908 (1910), vol. XXVIII, p. 907–916. *Doc. 689 issued April, 1910.* 10–35564

Walker, C. H.: Location of a salmon hatchery in Oregon. Bulletin, 1885 (1885), vol. V, p. 309–310. F18–455

Ward, F. M.: Young salmon in northern New Jersey. Bulletin, 1886 (1887), vol. VI, p. 345. F18–608

Ward, Henry Baldwin: Internal parasites of the Sebago salmon. (Bibliography: p. 1192–1194.) Bulletin, 1908 (1910), vol. XXVIII, p. 1151–1194, pl. CXXI. *Doc. 713 issued April, 1910.* 10–35558

Waterbury, E. B.: Obstructions to salmon in Pend d'Oreille River, Montana, requiring a fish-way or removal of falls. Bulletin, 1883 (1883), vol. III, p. 421–423. F18–158

Watson, W. C.: The salmon of Lake Champlain and its tributaries. Report, 1873–74 and 1874–75 (1876), p. 531–540. F16–26

Whitcombe, W. P.: Shipment of whitefish eggs to the Ballarat Fish Acclimatization Society. Bulletin, 1885 (1885), vol. V, p. 329–330. F18–468

Whitefish, lake trout, and brook trout in France. Bulletin, 1884 (1884), vol. IV, p. 112. F18–283

Wilmot, Samuel: Introduction of California salmon into Ontario, with remarks on the disappearance of Maine salmon from that province. Bulletin, 1881 (1882), vol. I, p. 347–349. F20–146

——— Remarks on the scarcity of male grilse salmon in the rivers of Ontario, Canada. Bulletin, 1881 (1882), vol. I, p. 379–381. F20–148

Wilson, Charles A.: Raising brook trout in mineral water. Bulletin, 1882 (1883), vol. II, p. 392. F18–112

Yarrow, Harry Crécy: On the speckled trout of Utah Lake (*Salmo virginalis* Girard). Report, 1872 and 1873 (1874), p. 363–368. F15–105

SCARIDÆ.

Goode, George Brown: [The parrot fishes and some of their allies.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 274–275.

Jenkins, Oliver Peebles: Descriptions of new species of fishes from the Hawaiian Islands, belonging to the families Labridæ and Scaridæ. Bulletin, 1899 (1901), vol. XIX, p. 45–65, illus. *Doc. 433 issued Aug. 30, 1900.* F12–45

SCIÆNIDÆ.

Crozier, William J., and Selig Hecht: Correlations of weight, length, and other body measurements in the weakfish, *Cynoscion regalis*. Bulletin, 1913 (1915), vol. XXXIII, p. 141–147, illus. *Doc. 800 issued Sept. 17, 1914.* F14–101

Eigenmann, Carl H.: Investigation into the history of the young squeteague. Bulletin, 1901 (1902), vol. XXI, p. 45–51, illus. *Doc. 477 issued Oct. 12, 1901.* F12–264

Goode, George Brown: [The drum family.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 362.

——— [The squeteague—*Cynoscion regale*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 362–365.

——— [The spotted squeteague—*Cynoscion maculatum*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 365–367.

——— [The drum—*Pogonias chromis*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 367–369.

——— [The spot, or Lafayette—*Liostomus xanthurus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 370–371.

——— [The red fish, or bass of the South—*Sciaena ocellata*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 371–375.

——— [The yellow tail—*Bairdiella chrysura*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 375.

——— [The kingfish—*Menticirrus nebulosus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 375–376.

——— [The whitings—*Menticirrus alburnus* and *M. Littoralis*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 376–378.

——— [The croker—*Micropogon undulatus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 378.

Hughes, Smith E.: [Live ponds for weakfish in New Jersey.] Bulletin, 1881 (1882), vol. I, p. 349–351.

Jordan, David Starr: [The fresh-water drum—*Haploidonotus grunniens*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 370.

——— [The corvinas and roncadors of the Pacific coast.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 378–380.

Jordan, David Starr, and Carl H. Eigenmann: A review of the Sciaenidæ of America and Europe. Report, 1886 (1889), p. 343–451. *Doc. 127 issued 1889.* F11–254

Kuntz, Albert: The embryology and larval development of *Bairdiella chrysura* and *Anchovia mitchilli*. Bulletin, 1913 (1914), vol. XXXIII, 19 p., illus. *Doc. 795 issued May 29, 1914.* F14–38

Parker, George Howard: Structure and functions of the ear of the squeteague. (Bibliography: p. 1222–1224.) Bulletin, 1908 (1910), vol. XXVIII, p. 1211–1224, pl. CXXII. *Doc. 715 issued May 5, 1910.* 10–35606

Rathbun, Richard: [Eggs of spotted weakfish successfully hatched on *Fish Hawk*.] Report, 1888–89 (1892), p. LIX.

——— [First attempt at artificial propagation of the squeteague.] Report, 1889–91 (1893), p. 160.

Taylor, Harden Franklin: The structure and growth of the scales of the squeteague and the pigfish as indicative of life history. (Bibliography: p. 325–330.) Bulletin, 1914 (1915), vol. XXXIV, p. 285–330, illus., pl. L–LIX. *Doc. 823 issued Sept. 23, 1916.* F16–133

Tower, Ralph Winfred: Biliary calculi in the squeteague. Bulletin, 1901 (1902), vol. XXI, p. 131–135, pl. XXI. *Doc. 498 issued May 23, 1902.* F12–413

SCOMBERESOCIDÆ.

Goode, George Brown: [The flying-fish family—Scomberesocidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 459.

Ryder, John Adam: Development of the silver gar (*Belone longirostris*), with observations on the genesis of the blood in embryo fishes, and a comparison of fish ova with those of other vertebrates. Bulletin, 1881 (1882), vol. I, p. 283–301, pl. XIX–XXI. F12–323

SCOMBRIDÆ.

Chadwick, B. P.: Young mackerel destroyed by small-meshed seines. Bulletin, 1886 (1887), vol. VI, p. 193. F18–570

Collins, Joseph William: Notes on the movements, habits, and captures of mackerel for the season of 1882. Bulletin, 1882 (1883), vol. II, p. 273–285. F12–363

——— Movements of mackerel in winter. Bulletin, 1884 (1884), vol. IV, p. 15. F18–205

——— A search for mackerel off Block Island, Montauk, and Sandy Hook, in November, 1883. Bulletin, 1884 (1884), vol. IV, p. 49–51. F18–213

——— On the scarcity of mackerel in the Gulf of Saint Lawrence. Bulletin, 1884 (1884), vol. IV, p. 427–430 and 435–438. F18–359

Dressler, Fletcher B., and Bert Fesler: A review of the mackerels (Scombrinæ of America and Europe. Bulletin, 1887 (1889), vol. VII, p. 429–446, pl. I–XI. F18–680

Earll, R. Edward: The Spanish mackerel: its natural history and artificial propagation, with an account of the origin and development of the fishery. Report 1880 (1883), p. 395–426, III pl. *Doc. 60 issued July 9, 1883.* F11–332

——— Hatching blackfish and Spanish mackerel. Bulletin, 1884 (1884), vol. IV, p. 415–416. F18–353

Goode, George Brown: [The mackerel and its allies.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 281–303.

——— [The chub mackerel—*Scomber colias*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 303–305.

——— [The frigate mackerel—*Auxis thazard*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 305–307.

——— [The Spanish mackerel and its allies.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 307–316.

——— [The bonito—*Sarda mediterranea*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 316–320.

——— [The horse mackerel, tunny, or albicore.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 320–322.

——— [The little tunny or albicore.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 322.

Goode, George Brown; Joseph W. Collins; R. E. Earll; and Howard Clark: Materials for a history of the mackerel fishery. (*Contents.*—Natural history, by G. Brown Goode. The mackerel fishery of the United States, by G. Brown Goode and J. W. Collins. Legislation for the protection of mackerel. Statistics of the mackerel fishery in 1880, by R. E. Earll. The mackerel canning industry, by R. E. Earll. Methods of packing and inspection laws, by A. H. Clark. Statistics of inspection of mackerel from 1804 to 1880, by A. H. Clark. Chronological notes, by J. W. Collins. Inspection laws, comp. by A. H. Clark. The mackerel fleet. Mackerel fishery in the Gulf of Saint Lawrence.) Report, 1881 (1884), 441 p., fold. diagr. *Doc. 52 issued Jan. 3, 1883.* 7–38960

Kite, J. Alban: Report upon apparatus and facilities needed for hatching Spanish mackerel. Report, 1883 (1885), p. 1095–1100, illus. F17–40

McDonald, Marshall: Spanish mackerel—investigations at Cherrystone, Va., during the summer of 1881. Report, 1881 (1884), p. 1131–1133. F16–348

Martin, Stephen J.: Notes on the mackerel fishery of 1881. Bulletin, 1881 (1882), vol. I, p. 132–133. F18–30

——— Movements and catch of mackerel. Bulletin, 1882 (1883), vol. II, p. 89–90; 1883 (1883), vol. III, p. 295–296, 470. F18–78

Merchant, George, jr.: The incipiency of night seining for mackerel. Bulletin, 1884 (1884), vol. IV, p. 142. F18–251

Moore, John Percy: Report on mackerel investigations in 1897. Report, 1898 (1899), p. 1–22. *Doc. 399 issued Mar. 28, 1899.* F11–111

Nye, Willard: Eels (*Anguilla rostrata*) in New Bedford water pipes—Mackerel abundant in Amherst River. Bulletin, 1882 (1883), vol. II, p. 272. F18–102

Phillips, Barnet: Early catch of mackerel. Bulletin, 1883 (1883), vol. III, p. 280. F18–136

Ryder, John Adam: Development of the Spanish mackerel (*Cybium maculatum*). Bulletin, 1881 (1882), vol. I, p. 135–173, pl. I–IV. F12–317

Smith, Hugh McCormick: The southern spring mackerel fishery of the United States. Bulletin, 1898 (1899), vol. XVIII, p. 193–271. *Doc. 411 issued Oct. 19, 1899.* F12–97

Tanner, Zera Luther: Movements of mackerel. Bulletin, 1883 (1883), vol. III, p. 471. F18–196

Wood, William Maxwell: Report of operations in hatching eggs of Spanish mackerel in Chesapeake Bay by the steamer *Fish Hawk* during the summer of 1883. Report, 1883 (1883), p. 1089–1094, illus. F17–39

SCOPELIDÆ.

Goode, George Brown: [The scopelus family—Scopelidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 547.

SCORPÆNIDÆ.

Eigenmann, Carl H.: On the viviparous fishes of the Pacific coast of North America. Bulletin, 1892 (1894), vol. XII, p. 381–478, pls. XCIV–CXVIII. *Doc. 231 issued June 26, 1894.* F12–159

Goode, George Brown: [Rosefish or red perch—*Sebastes marinus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 260–262.

Jordan, David Starr: [The rock cods of the Pacific.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 262–267.

Ryder, John Adam: On the intraovarian gestation of the redfish (*Sebastes marinus*). Bulletin, 1886 (1887), vol. VI, p. 92–94. F18–546

SCYTALINIDÆ.

Goode, George Brown: [The Congrogadus family—Congrogadidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, p. III, p. 243.

SERRANIDÆ.

Burns, Frank: Rockfish in South Carolina. Bulletin, 1886 (1887), vol. VI, p. 124–125. F18–558

Goode, George Brown: [The sea bass—*Serranus atrarius*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 407–410.

——— [The groupers.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 410–413.

——— [The striped bass—*Roccus lineatus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 425–428.

——— [The yellow bass.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 431.

——— [The white perch—*Roccus americanus*.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 431–433.

Harrell, J. Dock: [Striped bass in Tangipahoa River.] Bulletin, 1885 (1885), vol. V, p. 96.

Healy, R.: Striped bass in Piankatank River, Virginia. Bulletin, 1882 (1883), vol. II, p. 75–76. F18–75

Jordan, David Starr: A review of the genera and species of Serranidæ found in the waters of America and Europe. Bulletin, 1888 (1890), vol. VIII, p. 329–441, pl. LX–LXIX. *Doc. 144 issued Mar. 25, 1891.* F11–325

——— [The serranoid fishes of the Pacific coast.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 413–414.

Mason, Harry W.: Report of operations on the Navesink River, New Jersey, in 1879, in collecting living striped bass for transportation to California. Report, 1879 (1882), p. 663–666. F17–15

Mosher, Gideon: Do striped bass (*Roccus lineatus*) feed on menhaden? Bulletin, 1883 (1883), vol. III, p. 410. F18–154

Norny, E. R.: On the propagation of the striped bass. Bulletin, 1881 (1882), vol. I, p. 67–68. F18–25

——— A proposed pond for rearing striped bass (*Roccus lineatus*) in Delaware Bay. Bulletin, 1881 (1882), vol. I, p. 260–261. F18–48

Ryder, John Adam: The micropyle of the egg of the white perch. Bulletin, 1881 (1882), vol. I, p. 282. F18–53

Smiley, Charles Wesley: Occurrence of black grouper or jew-fish off Block Island. Bulletin, 1884 (1884), vol. IV, p. 240. F13–104

Throckmorton, S. R.: The introduction of striped bass into California. Bulletin, 1881 (1882), vol. I, p. 61–62. F18–21

Wilson, Henry Van Peters: The embryology of the sea bass (*Serranus atrarius*). (List of papers referred to: p. 271–272.) Bulletin, 1889 (1891), vol. IX, p. 209–277. illus., pls. LXXXVIII–CVII. *Doc. 160 issued July 7, 1891.* F12–148

Worth, Stephen G.: The artificial propagation of the striped bass (*Roccus lineatus*) on Albemarle Sound. Bulletin, 1881 (1882), vol. I, p. 174–177, pl. I–III. F18–34

——— Report upon the propagation of striped bass at Weldon, N. C., in the spring of 1884. Report, 1884 (1884), vol. IV, p. 225–231. F13–100

——— Prospectus of striped bass operations for the season of 1885. Bulletin, 1885 (1885), vol. V, p. 35–36. F18–371

——— The striped bass or rockfish industry of Roanoke Island, N. C., and vicinity. Bulletin, 1887 (1889), vol. VII, p. 193–197. F18–666

SILURIDÆ.

Gardner, A. P.: Experiments in the pond culture of trout, suckers, and catfish. Bulletin, 1883 (1883), vol. III, p. 417–420. F18–157

Hiester, Charles E.: Answers to questions relative to catfish. Bulletin, 1882 (1883), vol. II, p. 76–79. F18–76

Jones, J. F.: The speckled catfish. Bulletin, 1884 (1884), vol. IV, p. 321–322. F18–323

Jordan, David Starr: Proposed propagation of catfish as a food-fish. Bulletin, 1884 (1884), vol. IV, p. 292. F18–316

——— [The catfish family—Siluridæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I. pt. III, p. 627–629.

——— The habits and value for food of the American channel catfish (*Ictalurus punctatus* Rafinesque). Bulletin, 1885 (1885), vol. V, p. 34. F18–372

Jordan, David Starr, and Charles H. Gilbert: A review of the siluroid fishes found on the Pacific coast of tropical America, with descriptions of three new species. Bulletin, 1882 (1883), vol. II, p. 34–54. F12–345

Jousset de Bellesme, Georges Louis Marie Felicien: American catfish in the Trocadéro aquarium of Paris. Bulletin, 1886 (1887), vol. VI, p. 257. F18–586

Kendall, William Converse: Habits of some of the commercial catfishes. Bulletin, 1902 (1904), vol. XXII, p. 399–409. *Doc. 532 issued Aug. 9, 1903.* F12–71

——— American catfishes: Habits, culture, and commercial importance. Report and special papers. 1908 (1910), 39 p., X pl. *Doc. 733 issued Aug. 23, 1910.* 10–35947

Lefebvre, Alfred: The proposed introduction of American catfish into the rivers of Belgium. Bulletin, 1882 (1883), vol. II, p. 153–154.

Lewis, George A.: [Gaff-topsail catfish taken in Narraganset Bay.] Bulletin, 1886 (1887), vol. VI, p. 144.

McDonald, Marshall: Transferring catfish from the Potomac to the Colorado River, Arizona. Bulletin, 1884 (1884), vol. IV, p. 212. F18–284

Ryder, John Adam: Preliminary notice of the development and breeding habits of the Potomac catfish, *Amiurus albidus* (Lesueur) Gill. Bulletin, 1883 (1883), vol. III, p. 225–230. F12–393

Smiley Charles Wesley: Sending catfish to Europe. Bulletin, 1885 (1885), vol. V, p. 433–434. F18–497

Smith, Hugh McCormick, and Leighton G. Harron: Breeding habits of the yellow catfish. Bulletin, 1902 (1904), vol. XXII, p. 149–154. *Doc. 517 issued Mar. 30, 1903.* F12–61

Wilson, Thomas: The proposed introduction of catfish into Ghent. Bulletin, 1881 (1882), vol. I, p. 340. F20-

SOLEIDÆ.

Goode, George Brown: [The American soles—Soleidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 175–177.

SPARIDÆ.

Baird, Spencer Fullerton: [Natural history of some of the more important food fishes of the south shore of New England (scup).] Report, 1871–72 (1873), p. 228–235.

Goode, George Brown: [The sheepshead family—Sparidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 381.

——— [The sheepshead—*Diplodus probatocephalus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 381–386.

——— [The scup or scuppaug—*Stenotomus versicolor* and *S. Gardeni.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 386-393.

——— [The sailor's choice—*Lagodon rhomboides.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 393–394.

——— [Certain minor sparoids.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 394–395.

Jordan, David Starr: A review of the sparoid fisheries of America and Europe. Report, 1889–91 (1893), p. 421–544, pl. 28-62. *Doc. 219 issued Oct. 28, 1893.* F14–84

SPHYRÆNIDÆ.

Goode, George Brown: [The barracouta family—Sphyrænidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 448.

Smith, Hugh McCormick: [Valuable food fish of California.] Bulletin, 1894 (1895), vol. XIV, p. 230–231.

STROMATEIDÆ.

Goode, George Brown: [The rudder-fish family—Stromateidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 332-334.

SYNGNATHIDÆ.

Goode, George Brown: [The pipe-fish family—Syngnathidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 172–173.

Ryder, John Adam: A contribution to the development and morphology of the Lophobranchiates (*Hippocampus antiquorum*, the sea horse). Bulletin, 1881 (1882), vol. I, p. 191–199, pl. XVII. F12–320

SYNODONTIDÆ.

Goode, George Brown: [The snake fish family—Synodontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 548.

TETRODONTIDÆ.

Goode, George Brown: [The bellows-fish family—Tetrodontidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 170.

TEUTHIDIDÆ.

Goode, George Brown: [The surgeon-fish family—Acanthuridæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 279–280.

THYMALLIDÆ.

Goode, George Brown: [The grayling—*Thymallus tricolor.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 505-507.

Milner, James W.: Notes on the grayling of North America, [and descriptions of new species of Coregonus and Argyrosomus.] Report, 1872–73 (1874), p. 729–742. F11–206

TRACHYPTERIDÆ.

Goode, George Brown: [The deal-fish family—Trachypteridæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 449.

TRICHIURIDÆ.

Goode, George Brown: [The cutlass-fish—*Trichiurus lepturus.*] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 335–336.

TRIGLIDÆ.

Goode, George Brown: [The sea-robin or gurnard family—Triglidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 255–258.

XIPHIIDÆ.

Clark, Alonzo Howard: Notes on the New England fishery for swordfish during the season of 1884. Report, 1884 (1886), p. 233–239. F17–126

Goode, George Brown: Materials for a history of the swordfish. Report, 1880 (1883), p. 289–394, XXIV pl. F16–284

——— [The sword-fish family—Xiphiidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 336–356.

ZENIDÆ.

Goode, George Brown: [The dory family—Zenidæ.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 335.

GEOGRAPHICAL DISTRIBUTION.

UNITED STATES.

GENERAL.

Baird, Spencer Fullerton, and Theodore Gill: Questions relative to the food-fishes of the United States. Report, 1871–72 (1873), p. 3–6. F12–213

Bean, Tarleton Hoffman: Catalogue of the collections of fishes exhibited by the United States National museum. *In* Great International fisheries exhibition, London, 1883. United States of America, 124 p. *Doc. 59 issued June 30, 1883.* F12–295

Eigenmann, Carl H.: Results of explorations in western Canada and northwestern United States. Bulletin, 1894 (1895), vol. XIV, p. 101–132, pl. 5–8. *Doc. 282 issued July 9, 1894.* 6–10551

Evermann, Barton Warren, and William Converse Kendall: Descriptions of new or little-known genera and species of fishes from the United States. Bulletin, 1897 (1898), vol. XVII, p. 125–133, pl. 6–9. *Doc. 358 issued Feb. 8, 1898.* F12–242

Gill, Theodore Nicholas: Catalogue of the fishes of the east coast of North America. Report, 1871–72 (1873), p. 779–822. F15–124

Jordan, David Starr: A catalogue of the fishes known to inhabit the waters of North America, north of the Tropic of Cancer, with notes on the species discovered in 1883 and 1884. Report, 1885 (1887), p. 789–973. *Doc. 94 issued Oct. 2, 1885.* F11–302

——— The geographical distribution of fresh-water food-fishes in the several hydrographic basins of the United States. *In* The fisheries and fishery industries of the United States. 1887. Sec. III, p. 133–154 incl. tables.

Jordan, David Starr, and Barton Warren Evermann: A check-list of the fishes and fish-like vertebrates of North and Middle America. Report, 1895 (1896), p. 207–584. *Doc. 336 issued Dec. 28, 1896.* F11–199

Kendall, William Converse, and Hugh McCormick Smith: Extension of the recorded range of certain marine and fresh-water fishes of the Atlantic coast of the United States. Bulletin, 1894 (1895), vol. XIV, p. 15–21. *Doc. 233 issued Mar. 19, 1894.* F12–172

Smith, Hugh McCormick, and William C. Kendall: Notes on the extension of the recorded range of certain fishes of the United States coasts. Report, 1896 (1898), p. 169–176. *Doc. 339 issued June 15, 1897.* F11–176

ALABAMA.

Gilbert, Charles Henry: Report of explorations made in Alabama during 1889, with notes on the fishes of the Tennessee, Alabama, and Escambia rivers. Bulletin, 1889 (1891), vol. IX, p. 143–159, II pl. *Doc. 157 issued June 16, 1891.* F12–145

ALASKA.

Bean, Tarleton Hoffman: Report on the salmon and salmon rivers of Alaska, with notes on the conditions, methods, and needs of the salmon fisheries. Bulletin, 1889 (1891), vol. IX, p. 165–208, LV pl. XLV–LXXXVII (partly fold.) *Doc. 159 issued June 11, 1891.* F12–147

Evermann, Barton Warren, and Edmund Lee Goldsborough: The fishes of Alaska. (Bibliography: p. 358–360.) Bulletin, 1906 (1907), vol. XXVI, p. 219–360, illus., pls. (partly col.). *Doc. 624 issued Dec. 6, 1907.* 7–35452

Gilbert, Charles Henry, and Charles Victor Burke: Fishes from Bering Sea and Kamchatka. Bulletin, 1910 (1912), vol. XXX, p. 31–96, illus. *Doc. 754 issued May 6, 1912.* F12–93

Jordan, David Starr, and R. C. McGregor: List of fishes collected at the Revillagigedo Archipelago and neighboring islands. Report, 1898 (1899), p. 271–284, pls. *Doc. 404 issued Mar. 22, 1899.* F11–116

Moser, Jefferson F.: The salmon and salmon fisheries of Alaska. Report of the operations of the United States Fish commission steamer *Albatross* for the year ending June 30, 1898. Bulletin, 1898 (1899), vol. XVIII, p. 1–178, illus., fold. charts, 63 pl. *Doc. 408 issued July 27, 1899.* F12–94

——— The salmon fisheries of Alaska. Report of the Alaska salmon investigations of the United States Fish commission steamer *Albatross* in 1900 and 1901. Bulletin, 1901 (1902), vol. XXI, 1 p. l., p. 173–398, 399*–401*, illus., fold. tables and charts, XLIV pl. *Doc. 510 issued Oct. 31, 1902.* F12–278

Rutter, Cloudsley: Notes on a collection of tide-pool fishes from Kadiak Island in Alaska. Bulletin 1898 (1899), vol. XVIII, p. 189–192, illus. *Doc. 410 issued Aug. 21, 1899.* F12–96

ARKANSAS.

Meek, Seth Eugene: Report of the explorations made in Missouri and Arkansas during 1889, with an account of the fishes observed in each of the river basins examined. Bulletin, 1889 (1891), vol. IX, p. 113–141, II pl. XLII. *Doc. 156 issued June 19, 1891.* F12–144

——— Report of investigations respecting the fishes of Arkansas conducted during 1891, 1892, and 1893, with a synopsis of previous explorations in the same State. Bulletin, 1894 (1895), vol. XIV, p. 67–94. *Doc. 280 issued May 5, 1894.* 6–12593

——— A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894. Bulletin, 1895 (1896), vol. XV, p. 341–350. *Doc. 306 issued Apr. 9, 1897.* 6–19634

CALIFORNIA.

Campbell, J. B.: Notes on McCloud River, California, and some of its fishes. Based upon a letter from J. B. Campbell. Bulletin, 1881 (1882), vol. 1, p. 44–46. F18–14

Evermann, Barton Warren: The golden trout of the southern high Sierras. (Bibliography: p. 50–51.) Bulletin, 1905 (1906), vol. XXV, p. 3–51, XVII pl. (partly col.) fold. map. *Doc. 595 issued May 19, 1906.* F11–66

Gilbert, Charles Henry: The fishes of the Klamath River basin. Bulletin, 1897 (1898), vol. XVII, p. 1–13, illus. *Doc. 351 issued Jan. 6, 1898.* 11–19957

——— Report on fishes obtained by the steamer *Albatross* in the vicinity of Santa Catalina Island and Monterey Bay. Report, 1898 (1899), p. 23–29, pls. *Doc. 400 issued Mar. 22, 1899.* F11–112

Greeley, Arthur White: Notes on the tide-pool fishes of California, with a description of four new species. Bulletin, 1899 (1901), vol. XIX, p. 7–20, illus. *Doc. 425 issued Dec. 13, 1899.* F12–41

Jordan, David Starr: Notes on the fresh-water species of San Luis Obispo County, California. Bulletin, 1894 (1895), vol. XIV, p. 141–142. *Doc. 288 issued Nov. 22, 1894.* F15–50

Jordan, David Starr, and Charles H. Gilbert: List of fishes inhabiting Clear Lake, California. Bulletin, 1894 (1895), vol. XIV, p. 139–140. *Doc. 288 issued Nov. 22, 1894.* F15–50

Juday, Chancey: Notes on Lake Tahoe, its trout and trout-fishing. (Literature cited: p. 146.) Bulletin, 1906 (1907), vol. XXVI, p. 133–146. *Doc. 615 issued May 11, 1907.* F11–63

Rutter, Cloudsley: Notes on the fishes from streams and lakes of northeastern California not tributary to the Sacramento River basin. Bulletin, 1902 (1904), vol. XXII, p. 143–148, illus. *Doc. 516 issued Mar. 30, 1903.* F12–60

——— The fishes of the Sacramento-San Joaquin basin, with a study of their distribution and variation. (Bibliographical review: p. 111–117.) Bulletin, 1907 (1908), vol. XXVII, p. 103–152, illus., pl. *Doc. 637 issued Sept. 28, 1908.* 8–35668

Smith, Hugh McCormick: [Fish.] Bulletin, 1894 (1895), vol. XIV, p. 282–285, 287, 288.

Snyder, John Otterbein: Notes on the fishes of the streams flowing into San Francisco Bay, California. Critical notes on *Mylocheilus lateralis* and *Leuciscus caurinus*. Report, 1904 (1905), p. 327–342, pl. *Doc. 574 issued July 14, 1905.* F10–9

——— The fishes of the coastal streams of Oregon and northern California. Bulletin, 1907 (1908), vol. XXVII, p. 153–189, illus., fold. map. *Doc. 638 issued Oct. 21, 1908.* 8–35707

——— The fishes of the streams tributary to Monterey Bay, California. Bulletin, 1912 (1913), vol. XXXII, p. 47–72, pl. XIX–XXIV. *Doc. 776 issued July 24, 1913.* F16–49

——— The fishes of the streams tributary to Tomales Bay, California. Bulletin, 1914 (1916), vol. XXXIV, p. 375–381, illus. *Doc. 825 issued June 2, 1916.* F16-107

——— The fishes of the Lahontan system of Nevada and northeastern California. Bulletin, 1915–16 (1918), vol. XXXV, p. 33–86, illus., pl. III–V (part fold.). *Doc. 843 issued Sept. 28, 1917.* F17–260

COLORADO.

Jordan, David Starr: Report of explorations in Colorado and Utah during the summer of 1889, with an account of the fishes found on each of the river basins examined. Bulletin 1889 (1891), vol. IX, p. 1–40, V pl. *Doc. 148 issued June 11, 1891.* F12–136

Juday, Chancey: List of fishes collected in Boulder County, Colorado, with description of a new species of Leuciscus. Bulletin, 1904 (1905), vol. XXIV, pl. 223–227, illus. *Doc. 565 issued Mar. 17, 1905.* F12–50

——— A study of Twin Lakes, Colorado, with special consideration of the food of the trouts. (Bibliography: p. 175–178.) Bulletin, 1906 (1907), vol. XXVI, p. 147–178. *Doc. 616 issued May 24, 1907.* F11–64

DELAWARE.

Abbott, Charles Conrad: Notes on some fishes of the Delaware River. Report, 1875–76 (1878), pl. 825–845.

DISTRICT OF COLUMBIA.

Smith, Hugh McCormick, and Barton A. Bean: List of fishes known to inhabit the waters of the District of Columbia and vicinity. Bulletin, 1898 (1899), vol. XVIII, p. 179–187. *Doc. 409 issued Aug. 21, 1899.* F12–95

FLORIDA.

Clarke, H. R.: [Fish in Florida waters.] Bulletin, 1885 (1885), vol. V, p. 351.

Evermann, Barton Warren: The fish fauna of Florida. Bulletin, 1897 (1898), vol. XVII, p. 201–208. *Doc. 371 issued Aug. 8, 1898.* F12–110

Evermann, Barton Warren, and William Converse Kendall: Check-list of the fishes of Florida. Report, 1899 (1900), p. 35–103. *Doc. 419 issued Oct. 4, 1899.* 6–4028

Henshall, James Alexander: Report upon a collection of fishes made in southern Florida during 1889. Bulletin 1889 (1891), vol. IX, p. 371–389, IV. *Doc. 167 issued Aug. 10, 1891.* F12–154

——— Notes on fishes collected in Florida in 1892. Bulletin, 1894 (1895), vol. XIV, p. 209–221. *Doc. 292 issued May 20, 1895.* 6–12590

——— A plea for the development and protection of Florida fish and fisheries. Bulletin, 1897 (1898), vol. XVII, p. 253–255. *Doc. 377 issued Aug. 8, 1898* F12–110

Jordan, David Starr: The fishes of the Florida Keys. Bulletin, 1884 (1884), vol. IV, p. 77–80. F13–84

——— Notes on the fishes collected in the Tortugas Archipelago. Bulletin, 1902 (1904), vol. XXII, p. 539–544, 2 pl. *Doc. 547 issued Jan. 19, 1904.* F12–75

Jordan, David Starr, and Joseph C. Thompson: The fish fauna of the Tortugas Archipelago. Bulletin, 1904 (1905), vol. XXIV, p. 229–256, illus. *Doc. 568 issued May 3, 1905.* F12–9

Pierce, H. D.: Notes on the bluefish, mortality of Florida fishes, etc. Bulletin, 1884 (1884), vol. IV, p. 263–266 F18–307

Poey y Aloy, Felipe: List of food-fishes brought from Key West, Fla., into the markets of Havana. Bulletin, 1882 (1883), vol. II, p. 118. F18–88.

Poincy, J. W. de: Description of a fish-trap and oyster basin. Bulletin, 1885 (1885), vol. V, p. 134. F18–389

Smith, Hugh McCormick: Notes on Biscayne Bay, Florida, with reference to its adaptability as the site of a marine hatching and experiment station. Report, 1895 (1896), p. 169–191. *Doc. 333 issued Jan. 8, 1897.* F11–196

Stevens, M. E.: [The fish of Indian River.] Bulletin, 1885 (1885), vol. V, p. 98–99.

U. S. Bureau of Fisheries: Report on the fisheries of Indian River, Florida, transmitted to the U. S. Senate by the Commission of fish and fisheries, January 5, 1897. Report, 1896 (1898), p. 223–262, pls. *Doc. 341 issued June 16, 1897.* F11–179

——— Report on the fish and fisheries of the coastal waters of Florida, transmitted to the U. S. Senate by the Commissioner of fish and fisheries, January 28, 1897. Report, 1896 (1898), p. 263–342. *Doc. 342 issued Feb. 25, 1898.* F11–180

Woolman, Albert J.: Report upon the rivers of central Florida, tributary to the Gulf of Mexico, with list of fishes inhabiting them. Bulletin, 1890 (1892), vol. X, p. 293–302, pl. LII–LIII. *Doc. 198 issued Sept. 24, 1892.* F12–115

GEORGIA.

Gilbert, Charles H.: Notes on fishes from the lowlands of Georgia, with a description of a new species (*Opsopoeodus bollmani*). Bulletin, 1888 (1890), vol. VIII, p. 225–229. *Doc. 142 issued Apr. 28, 1891.* F11–323

Hudson, George A.: Carp caught in Ogeechee River. Bulletin, 1884 (1884), vol. IV, p. 123. F18–241

IDAHO.

Evermann, Barton Warren: A report upon salmon investigations in the headwaters of the Columbia River, in the State of Idaho, in 1895; together with notes upon the fishes observed in that State in 1894 and 1895. Bulletin, 1896 (1896), p. 149–202, pl. 67–72 (partly fold.). *Doc. 318 issued Nov. 17, 1896.* F11–343

Evermann, Barton Warren, and Seth Eugene Meek: A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific coast in 1896. Bulletin, 1897 (1898), vol. XVII, p. 15–84, illus., 2 pl. *Doc. 352 issued Jan. 6, 1898.* F12–241

ILLINOIS.

Nelson, Edward William: Fisheries of Chicago and vicinity. (Containing lists of species taken at Chicago and fishing in adjacent waters; and species in the Illinois River in the vicinity of Peoria.) Report, 1875–76 (1878), p. 783–800, illus F16–69

INDIAN TERRITORY.

Meek, Seth Eugene: [Two small collections of fish from Indian Territory.] Bulletin, 1894 (1895), vol. XIV, p. 94.

——— A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894 Bulletin, 1895 (1896), vol. XV, p. 341–350. *Doc. 306 issued Apr. 9, 1897.* 6–19634

INDIANA.

Kirsch, Philip H.: A report upon explorations made in Eel River basin in the northeastern part of Indiana in the summer of 1892. Bulletin, 1894 (1895), vol. XIV, p. 31–41. *Doc. 235 issued Mar. 24, 1894.* F12–175

Meek, Seth Eugene: Report of explorations made during the summer and autumn of 1888, in the Alleghany region of Virginia, North Carolina, and Tennessee, and in western Indiana, with an account of the fishes found in each of the river basins of those regions. Bulletin 1888 (1890), vol. VIII, p. 97–173, pl. XIII–XV. *Doc. 136 issued Mar. 13, 1890.* F11–318

IOWA.

Meek, Seth Eugene: Report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and 1891. Bulletin, 1890 (1892), vol. X, p. 217–248. *Doc. 195 issued Sept. 14, 1892.* F12–133

——— Notes on the fishes of western Iowa and eastern Nebraska. Bulletin, 1894 (1895), vol. XIV, p. 133–138. *Doc. 288 issued Nov. 22, 1894.* F15–50

KENTUCKY.

Evermann, Barton Warren: The fishes of Kentucky and Tennessee: A distributional catalogue of the known species. (Bibliography: p. 305–368.) Bulletin, 1915–16 (1918), vol. XXXV, p. 295–368. *Doc. 858 issued Jan. 10, 1918.* F18–5

Kirsch, Philip H.: Notes on the streams and fishes of Clinton County, Kentucky, with a description of a new darter. Bulletin, 1890 (1892), vol. X, p. 289–292, illus. *Doc. 197 issued Sept. 14, 1892.* F12–131

——— Notes on a collection of fishes from the southern tributaries of the Cumberland River in Kentucky and Tennessee. Bulletin, 1891 (1893), vol. XI, p. 259–268. *Doc. 211 issued May 25, 1893.* F12–158

Woolman, Albert J.: Report on an examination of the rivers of Kentucky, with lists of the fishes obtained. Bulletin, 1890 (1892), vol. X, p. 249–288, pl. II. *Doc. 196 issued Sept. 14, 1892.* F12–130

LOUISIANA.

Evermann, Barton Warren: Report on investigations by the U. S. Fish commission in Mississippi, Louisiana, and Texas in 1897. Report, 1898 (1899), p. 285–310, pls. *Doc. 405 issued Mar. 21, 1899.* F11–117

MAINE.

Hanna, S. W.: Description of an eel-like creature taken in a net at New Harbor, Maine, in 1880. Bulletin, 1883 (1883), vol. III, p. 407–410, illus. F18–153

Kendall, William Converse: Notes on the fresh-water fishes of Washington County, Maine. Bulletin, 1894 (1895), vol. XIV, p. 43–54. *Doc. 236 issued Mar. 24, 1894.* F12–173

——— [Fishes of Lake Sebago and Lake Cobbosseecontee.] Report, 1900 (1901), p. 128–129.

——— Notes on some fresh-water fishes from Maine, with descriptions of three new species. Bulletin, 1902 (1904), vol. XXII, p. 353–368, illus. *Doc. 531 issued Aug. 14, 1903.* F12–68

——— Fishes and fishing in Sunapee Lake. Report and special papers, 1912 (1914), 96 p., illus., IX pl. (part. col.). *Doc. 783 issued Jan. 28, 1914.* F14–1

——— The Rangeley Lakes, Maine; with special reference to the habits of the fishes, fish culture, and angling. Bulletin, 1915–16 (1918), vol. XXXV, p. 485–594, illus., pl. XL–XLVI (part. col.). *Doc. 861 issued May 25, 1918.* F18–682

MARYLAND.

Smith, Hugh McCormick: Notes on fishes from the lower Potomac River. Bulletin, 1890 (1892), vol. X, p. 63–72, pl. XVIII–XX. *Doc. 189 issued June 30, 1892.* F12–128

Smith, Hugh McCormick, and Barton A. Bean: List of fishes known to inhabit the waters of the District of Columbia and vicinity. Bulletin, 1898 (1899), vol. XVIII, p. 179–187. *Doc. 409 issued Aug. 21, 1899.* F12–95

MASSACHUSETTS.

Baird, Spencer Fullerton: Natural history of some of the more important food-fishes of the south shore of New England. Report, 1871–72 (1873), p. 228–252. F15–100

——— List of fishes collected at Woods Hole. Report, 1871 and 1872 (1873), p. 821–827. F15–125

Bean, Tarleton Hoffman: List of fishes collected by the U. S. Fish commission at Woods Hole, Massachusetts, during the summer of 1881. Report, 1882 (1884), p. 339–344. *Doc. 87 issued Sept. 26, 1884.* F11–307

Gill, Theodore Nicholas: State ichthyology of Massachusetts. Report, 1904 (1905), p. 163–188. *Doc. 567 issued Apr. 22, 1905.* 8–30676

Goode, George Brown: The natural and economical history of the American menhaden. Report, 1877 (1879), XII, 529 p., XXXI pl. F12–236

Luce, Thomas R.: Occurrence of *Balistes capriscus* Gmelin (leather-jacket or file-fish) at New Bedford, Mass. Bulletin, 1883 (1883), vol. III, p. 469. F18–193

Mather, Fred: [Note on sea bass, skates, etc.] Bulletin, 1884 (1884), vol. IV, p. 365.

Sherwood, George H., and Vinal N. Edwards: [Notes on the migration, spawning, abundance, etc., of certain fishes in 1900.] Bulletin, 1901 (1902), vol. XXI, p. 27–31.

Smith, Hugh McCormick: The fishes found in the vicinity of Wood's Hole. Bulletin, 1897 (1898), vol. XVII, p. 85–111, illus., pl. 3 (fold.). *Doc. 353 issued Jan. 6, 1898.* F12–401

——— [Additions to the fish fauna of the Woods Hole region in 1900.] Bulletin, 1901 (1902), vol. XXI, p. 32.

——— [Notes on the subtropical fishes observed at Woods Hole in 1900.] Bulletin, 1901 (1902), vol. XXI, p. 32–33.

U. S. Fisheries biological laboratory, Woods Hole: Biological notes no. 1. Bulletin, 1899 (1901), vol. XIX, p. 305–310. *Doc. 447 issued Aug. 30, 1900.* 7–31521

——— Biological notes no. 2. Bulletin, 1901 (1902), vol. XXI, p. 27–33. *Doc. 474 issued Sept. 26, 1901.* 7–31521

Verrill, Addison Emory: Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, and of some additions to the fauna of Vineyard Sound. Report, 1882 (1884), p. 641–669. F11–267

MICHIGAN.

Bollman, Charles H.: A report upon the fishes of Kalamazoo, Calhoun, and Antrim counties, Michigan. Bulletin, 1888 (1890), vol. VIII, p. 219–225. *Doc. 141 issued Mar. 25, 1891.* F11–322

Reighard, Jacob Ellsworth: An ecological reconnoissance of the fishes of Douglas Lake, Cheboygan County, Michigan, in midsummer. (Literature cited: p. 249.) Bulletin, 1913 (1915), vol. XXXIII, p. 215–249, illus. *Doc. 814 issued Oct. 11, 1915.* F15–90

MINNESOTA.

Cox, Ulysses Orange: A report upon the fishes of southwestern Minnesota. Report, 1894 (1896), p. 605–616, map. *Doc. 328 issued Dec. 14, 1896.* F11–194

Woolman, Albert J.: Report upon ichthyological investigations in western Minnesota and eastern North Dakota. Report, 1893 (1895), p. 343–372, map. *Doc. 312 issued Mar. 23, 1896.* F17–122

MISSISSIPPI.

Evermann, Barton Warren: Report on investigations by the United States Fish commission in Mississippi, Louisiana, and Texas in 1897. Report, 1898 (1899), p. 285–310, pls. *Doc. 405 issued Mar. 21, 1899.* F11–117

MISSOURI.

…nn, Barton Warren: Report upon the fishes of the Missouri River basin.
1896), p. 325–429. *Doc. 324 issued Nov. 27, 1896.* F11–190
Warren, and Kendall, William Converse: A list of the
wn from the vicinity of Neosho, Missouri. Bulletin, 1894
egions -472. *Doc. 297 issued May 23, 1896.* 6–10564
Mar. 13, of explorations made in Missouri and Arkansas during
H.: Notes on a co es observed in each of the river basins examined.
nd River in Kentucky 113–141, II, pl. XLII. *Doc. 156 issued June*
268. *Doc. 211 issued May 2* F12–144

MONTANA.

Evermann, Barton Warren: [Annotated list of fishes obtained in Montana.] Bulletin, 1891 (1893), vol. XI, p. 41–52.

NEBRASKA.

Meek, Seth Eugene: Notes on the fishes of western Iowa and eastern Nebraska. Bulletin, 1894 (1895), vol. XIV, p. 133–138. *Doc. 288 issued Nov. 22, 1894.* F15–50

NEVADA.

Snyder, John Otterbein: The fishes of the Lahontan system of Nevada and northeastern California. Bulletin, 1915–16 (1918), vol. XXXV, 1 p. l., p. 33–86, illus., pl. III–V (part fold.). *Doc. 843 issued Sept. 28, 1917.* F17–260

NEW HAMPSHIRE.

Kendall, William Converse: Fishes and fishing in Sunapee Lake. Report and special papers, 1912 (1914), 96 pl., illus., IX pl. (part col.). *Doc. 783 issued Jan. 28, 1914.* F14–1

Kendall, William Converse, and E. L. Goldsborough: Fishes of the Connecticut Lakes and neighboring waters, with notes on the plankton environment. (By A. A. Doolittle: p. 65–77.) Report and special papers, 1907 (1909), 77 p., 12 pls., fold. map, fold. diagr. *Doc. 633 issued July 6, 1908.* 8–35558

NEW JERSEY.

Abbott, Charles Conrad: Notes on some fishes of the Delaware River. Report, 1875–76 (1878), p. 825–845.

Bean, Tarleton Hoffman: Report on the fishes observed in Great Egg Harbor Bay, New Jersey, during the summer of 1887. Bulletin, 1887 (1889), vol. VII, p. 129–154 incl. tables, pl. I–III. *Doc. 122 issued Dec. 8, 1888.* F11–251

Moore, Henry Frank: List of fishes collected at Sea Isle City, New Jersey, during the summer of 1892. Bulletin, 1892 (1894), vol. XII, p. 357–364. *Doc. 229 issued Feb. 28, 1894.* F12–161

Smith, Hugh McCormick: Economic and natural history notes on fishes of the northern coast of New Jersey. Bulletin, 1892 (1894), vol. XII, p. 365–380. *Doc. 230 issued Mar. 8, 1894.* F12–162

Van Mater, J. H.: Occurrence of *Balistes vetula* on the New Jersey coast. Bulletin, 1884 (1884), vol. IV, p. 13. F18–203

Ward, F. M.: Young salmon in northern New Jersey. Bulletin, 1886 (1887), vol. VI, p. 345. F18–608

NEW MEXICO.

Evermann, Barton Warren: The fishes of Texas and the Rio Grande basin considered chiefly with reference to their geographical distribution. ("Annotated list of the reptiles and batrachian collected in Missouri and Texas in the fall of 1891. By F. C. Test": p. 121.) Bulletin, 1892 (1894), vol. XII, p. 57–126. *Doc. 225 issued Feb. 6, 1894.* F12–160

NEW YORK.

Bean, Tarleton Hoffman: Notes upon an exploration on Long Island Sound. Bulletin, 1885 (1885), vol. V, p. 33. F18–370

Evermann, Barton Warren, and E. L. Goldsborough: Notes on the fishes and mollusks of Lake Chautauqua, New York. Report, 1901 (1902), p. 169–175. *Doc. 483 issued Mar. 28, 1902.* F11–19

Loomis, Watts T.: A landlocked salmon caught in Erie Canal. Bulletin, 1884 (1884), vol. IV, p. 288. F18–312

Mather, Fred: Notes on cod, shrimp, etc., at Cold Springs Harbor. Bulletin, 1884, 1884), vol. IV, p. 123. F18–242

Merriam, C. Hart: The fish of Lake Champlain. Bulletin, 1884 (1884), vol. IV, p. 287–288. F13–106

Morgan, George: Capture of landlocked salmon at [illegible] York. Bulletin, 1882 (1883), vol. II, p. 15. F18–65

NORTH CAROLINA.

Evermann, Barton Warren, and Ulysses O. Cox: The fishes of the Neuse River basin. (Bibliography: p. 306–308.) Bulletin, 1895 (1896), vol. XV, p. 203–210. *Doc. 303 issued Mar. 2, 1896.* 6–10544

Jordan, David Starr: Report of explorations made during the summer and autumn of 1888, in the Alleghany region of Virginia, North Carolina, and Tennessee, and in western Indiana, with an account of the fishes found in each of the river basins of those regions. Bulletin, 1888 (1889), vol. VIII, p. 97–173. *Doc. 136 issued Mar. 13, 1890.* F11–318

Linton, Edwin: [List of fifty-nine species of Beaufort fishes.] Bulletin, 1904 (1905), vol. XXIV, p. 339–416.

Milligan, John D.: [Fishes in Lake Mattamuskeet.] Report, 1900 (1901), p. 133–134.

Smith, Hugh McCormick: Report on a collection of fishes from the Albemarle region of North Carolina. Bulletin, 1891 (1893), vol. XI, p. 185–200. *Doc. 208 issued Mar. 22, 1893.* F11–352

NORTH DAKOTA.

Lord, Henry W.: The fish of Devil's Lake, Dakota. Bulletin, 1884 (1884), vol. IV, p. 351. F18–329

Pope, Thomas E. B.: Devils Lake, North Dakota. A study of physical and biological conditions, with a view to the acclimatization of fish. Report and special papers, 1907 (1909), 22 p., 3 pl., fold. map. *Doc. 634 issued July 16, 1908.* 8–35574

Woolman, Albert J.: Report upon ichthyological investigations in western Minnesota and eastern North Dakota. Report, 1893 (1895), p. 343–372, map. *Doc. 312 issued Mar. 23, 1896.* F17–122

OHIO.

Evermann, Barton Warren: Description of a new species of shad (*Alosa ohiensis*) with notes on other food fishes of the Ohio River. Report, 1901 (1902), p. 273–288. *Doc. 499 issued May 26, 1902.* F11–24

Hobbs, Orlando: A list of Ohio River fishes sold in the markets. Bulletin, 1881 (1882), vol. I, p. 124–125. F18–28

OREGON.

Evermann, Barton Warren, and Seth Eugene Meek: A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific coast in 1896. Bulletin, 1897 (1898), vol. XVII, p. 15–84, illus., 2 pl. *Doc. 352 issued Jan. 6, 1898.* F12–241

Gilbert, Charles Henry: The fishes of the Klamath basin. Bulletin, 1897 (1898), vol. XVII, p. 1–13. *Doc. 351 issued Jan. 6, 1898.* 11–19957

Jordan, David Starr: The mountain or salmon trout of Oregon. Bulletin, 1885 (1885), vol. V, p. 310. F18–456

Snyder, John Otterbein: Relationship of the fish fauna of the lakes of southeastern Oregon. Bulletin, 1907 (1908), vol. XXVII, p. 69–102, illus., fold. map, diagrs. *Doc. 636 issued Sept. 26, 1908.* 8–35669

——— The fishes of the coastal streams of Oregon and northern California. Bulletin, 1907 (1908), vol. XXVII, p. 153–189, illus., fold. map. *Doc. 638 issued Oct. 21, 1908.* 8–35707

TENNESSEE.

Evermann, Barton Warren: The fishes of Kentucky and Tennessee: A distributional catalogue of the known species. (Bibliography: p. 305–332.) Bulletin, 1915–16 (1918), vol. XXXV, p. 295–368. *Doc. 858 issued Jan. 10, 1918.* F18–5

Evermann, Barton Warren, and Samuel F. Hildebrand: Notes on the fishes of east Tennessee. Bulletin, 1914 (1916), vol. XXXIV, p. 431–451, illus. *Doc. 832 issued Sept. 21, 1916.* F16–134

Hay, Oliver Perry: On a collection of fishes from the lower Mississippi Valley. Bulletin, 1882 (1883), vol. II, p. 57–75. F12–347

Jordan, David Starr: Report of explorations made during the summer and autumn of 1888, in the Alleghany region of Virginia, North Carolina and Tennessee, and in western Indiana, with an account of the fishes found in each of the river basins of those regions. Bulletin, 1888 (1890), vol. VIII, p. 97–173, pl. XIII–XV. *Doc. 136 issued Mar. 13, 1890.* F11–318

Kirsch, Philip H.: Notes on a collection of fishes from the southern tributaries of the Cumberland River in Kentucky and Tennessee. Bulletin, 1891 (1893), vol. XI, p. 259–268. *Doc. 211 issued May 25, 1893.* F12–158

TEXAS.

Evermann, Barton Warren: [Notes on Texas fishes, with descriptions of new species.] Bulletin, 1891 (1893), vol. XI, p. 75–88, pl. XXXV–XXXVI.

——— Report on investigations by the United States Fish commission in Mississippi, Louisiana, and Texas in 1897. Report, 1888 (1889), p. 285–310, pls. *Doc. 405 issued Mar. 21, 1899.* F11–117

Evermann, Barton Warren, and William Converse Kendall: The fishes of Texas and the Rio Grande basin, considered chiefly with reference to their geographic distribution. Bulletin, 1892 (1894), vol. XII, p. 57–126, pl. X–L. *Doc. 225 issued Feb. 6, 1894.* F12–160

UTAH.

Jordan, David Starr: Report of explorations in Colorado and Utah during the summer of 1889, with an account of the fishes found in each of the river basins examined. Bulletin 1889 (1891), vol. IX, p. 1–40, V pl. *Doc. 148 issued June 11, 1891.* F12–136

Siler, Andrew L.: Depletion of fish in Panguitch and Bear Lakes, Utah. Bulletin, 1884 (1884), vol. IV, p. 51. F18–214

Snyder, John Otterbein: Three new whitefishes from Bear Lake, Idaho and Utah. Bulletin, 1917–18 (1921), vol. XXXVI, 7 p., illus. *Doc. 864 issued May 7, 1919.* F19–35

VERMONT.

Evermann, Barton Warren, and William C. Kendall: An annotated list of the fishes known from the State of Vermont. Report, 1894 (1896), p. 579–604. *Doc. 327 issued Dec. 14, 1896.* F11–19

VIRGINIA.

Jordan, David Starr: Report of explorations made during the summer and autumn of 1888, in the Alleghany region of Virginia, North Carolina, and Tennessee, and in western Indiana, with account of the river basins of those regions. Bulletin, 1888 (1890), vol. VIII, p. 97–173, pl. XIII–XV. *Doc. 136 issued Mar. 13, 1890.* F11–318

Smith, Hugh McCormick, and Barton A. Bean: List of fishes known to inhabit the waters of the District of Columbia and vicinity. Bulletin, 1898 (1899), vol. XVIII, p. 179–187. *Doc. 409 issued Aug. 21, 1899.* F12–95

WASHINGTON.

Evermann, Barton Warren: [Fishes of the Columbia River basin.] Report, 1899 (1900), p. CXXV.

Evermann, Barton Warren, and Seth Eugene Meek: A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific coast in 1896. Bulletin, 1897 (1898), vol. XVII, p. 15–84, illus., 2 pl. *Doc. 352 issued Jan. 6, 1898.* F12–241

Rathbun, Richard: A review of the fisheries in the contiguous waters of the State of Washington and British Columbia. Report, 1899 (1900), p. 251–350, pl. 8–16. *Doc. 423 issued Nov. 15, 1899.* F11–108

Townsend, Charles Haskin: [Fish in Seattle market.] Bulletin, 1888 (1890), vol. VIII, p. 54.

WEST VIRGINIA.

Goldsborough, Edmund Lee, and Howard Walton Clark: Fishes of West Virginia. Bulletin 1907 (1908), vol. XXVII, p. 29–39, II p., illus. *Doc. 631 issued Mar. 19, 1908.* 8–35258

WISCONSIN.

Marshall, William Stanley, and N. C. Gilbert: Notes on the food and parasites of some fresh-water fishes from the lakes at Madison, Wis. (Bibliography, p. 522.) Report, 1904 (1905), p. 513–522. *Doc. 591 issued Dec. 29, 1905.* F10–13

WYOMING.

Curtis, J. E.: Fish in the National park and tributaries of Snake River . . . Bulletin, 1884 (1884), vol. IV, p. 335–336. F18–326

Evermann, Barton Warren: [Annotated list of fishes obtained in Wyoming.] Bulletin, 1891 (1893), vol. XI, p. 41–52.

Jordan, David Starr: A reconnoissance of the streams and lakes of the Yellowstone national park, Wyoming, in the interest of the United States Fish commission. Bulletin, 1889 (1891), vol. IX, p. 41–63, II, pl. VII–XXII, fold. map. *Doc. 149 issued July 11, 1891.* F12–137

Kendall, William Converse: The fishes of the Yellowstone national park. Appendix VIII, Report 1914 (1915), 28 p., front., illus. *Doc. 818 issued July 16, 1915.* F15–79

SOUTH ATLANTIC STATES.

Smith, Hugh McCormick: [Fishes, scientific names, common designations, and vernacular of the region.] Bulletin, 1891 (1893), vol. XI, p. 356, pl. XLII–LXXIV.

GREAT LAKES.

Evermann, Barton Warren: List of species of fishes known to occur in the Great Lakes or their connecting waters. Bulletin, 1901 (1902), vol. XXI, p. 95–96. *Doc. 486 issued Mar. 28, 1902.* F12–271

Evermann, Barton Warren, and W. C. Kendall: Notes on the fishes of Lake Ontario. An annotated list of the fishes known to occur in Lake Champlain and its tributary waters. An annotated list of the fishes known to occur in the St. Lawrence River. Report, 1901 (1902), p. 209–240. *Doc. 494 issued Apr. 28, 1902.* F11–21

Jordan, David Starr: Notes on fishes observed in Lake Superior. Bulletin, 1885 (1885), vol. V, p. 191–192. F18–404

Jordan, David Starr, and Barton Warren Evermann: A review of the salmonoid fishes of the Great Lakes, with notes on the whitefishes of other regions. Bulletin, 1909 (1911), vol. XXIX, p. 1–41, illus., col. pl. I–VII. *Doc. 737 issued Feb. 7, 1911.* F11–39

Milner, James W.: [Food fishes of the Great Lakes.] Report, 1872–73 (1874), p. 35–75.

Smith, Hugh McCormick: Report on the fisheries of Lake Ontario. Bulletin, 1890 (1892), vol. X, p. 177–215, pl. XXI–L. *Doc. 194 issued July 16, 1892.* F12–129

COLORADO RIVER.

Evermann, Barton Warren, and Cloudsley Rutter: The fishes of the Colorado basin. (Bibliography of the ichthyology of the Colorado basin: p. 476–480.) Bulletin, 1894 (1895), vol. XIV, p. 473–486. *Doc. 297 issued May 23, 1896.* 6–10564

COLUMBIA RIVER.

McDonald, Marshall; C. H. Gilbert; and B. W. Evermann: The salmon fisheries of the Columbia River basin, by Marshall McDonald . . . together with a report upon physical and natural-history investigations in the region, by C. H. Gilbert and B. W. Evermann. Bulletin, 1894 (1895), vol. XIV, p. 153–207, pl. 13–25 (partly fold.). *Doc. 290 issued Aug. 27, 1894.* F12–174

DELAWARE RIVER.

Abbott, Charles Conrad: Notes on some fishes of the Delaware River. Report, 1875–76 (1878), p. 825–845. F16–71

MAUMEE RIVER.

Kirsch, Philip H.: Report upon investigations in the Maumee River basin during the summer of 1893. Bulletin, 1894 (1895), vol. XIV, p. 315–337. *Doc. 295 issued May 22, 1895.* 6–10556

MISSISSIPPI RIVER.

Hay, Oliver Perry: On a collection of fishes from the lower Mississippi Valley. Bulletin, 1882 (1883), vol. II, p. 57–75. F12–347

Stringham, Emerson: [Names of fishes of the Mississippi River.] Appendix II, Report, 1918 (1920), p. 8–9.

MISSOURI RIVER.

Evermann, Barton Warren, and Ulysses O Cox: Report upon the Missouri River basin. Report, 1894 (1896), p. 325–429. *Doc. 324 issued Nov. 27, 1896.* F11–190

ST. LAWRENCE RIVER.

Evermann, Barton Warren: List of species of fishes known to occur in the Great Lakes or their connecting waters. Bulletin, 1901 (1902), vol. XXI, p. 95–96. *Doc. 486 issued Mar. 28, 1902.* F12–271

GULF OF MEXICO.

Phillips, Barnet: Notes on a trip to the Gulf of Mexico. Bulletin, 1884 (1884), vol. IV, p. 144. F18–255.

CANADA.

Eigenmann, Carl H.: Results of explorations in western Canada and the northwestern United States. Bulletin, 1894 (1895), vol. XIV, p. 101–132, pl. 5–8. *Doc. 282 issued July 9, 1894.* 6–10551

Gilbert, Charles Henry: Notes on fishes from the basin of the Mackenzie River in British America. Bulletin, 1894 (1895), vol. XIV, p. 23–25. *Doc. 234 issued Mar. 24, 1894.* F12–178

Nye, Willard: Notes taken during cruise of the *Albatross* to Grand Banks in June and July, 1885. Bulletin, 1885 (1885), vol. V, p. 336. F18–470

Rathbun, Richard: A review of the fisheries in the contiguous waters of the State of Washington and British Columbia. Report, 1899 (1900), p. 251-350, pl. 8–16. *Doc. 423 issued Nov. 15, 1899.* F11–108

WEST INDIES.

BAHAMAS.

Lee, Thomas: [Fishes collected by the *Albatross* in the Bahama Islands.] Report, 1886 (1889), p. 669–672.

CUBA.

Eigenmann, Carl H.: The fresh-water fishes of western Cuba. Bulletin, 1902 (1904), vol. XXII, p. 211–236, pl. 19–21. *Doc. 526 issued July 20, 1903.* F12–65

PORTO RICO.

Evermann, Barton Warren, and Millard Caleb Marsh: Descriptions of new genera and species of fishes from Porto Rico. Report, 1899 (1900), p. 351–362. *Doc. 427 issued Dec. 19, 1899.* 6–10554

——— The fishes of Puerto Rico. Bulletin, 1900 (1903), vol. XX, pt. 1, p. 49–350, illus., 52 pls. incl. 3 fold. maps. *Doc. 451 issued Dec. 15, 1900.* 5–4161

MEXICO.

Bean, Tarleton Hoffman: Notes on fishes collected at Cozumel, Yucatan, by the U. S. Fish commission, with descriptions of new species. Bulletin, 1888 (1890), vol. VIII, p. 193–206, pl. XXVIII–XXIX. *Doc. 138 issued Mar. 13, 1890.* F11–320

Evermann, Barton Warren, and Edmund Lee Goldsborough: A report on fishes collected in Mexico and Central America, with notes and descriptions of five new species. Bulletin, 1901 (1902), vol. XXI, p. 137–159, illus. *Doc. 495 issued May 3, 1902.* 6–37425

Evermann, Barton Warren, and William Converse Kendall: [Fishes of Mexico.] Bulletin, 1892 (1894), vol. XII, p. 89.

Jordan, David Starr, and Charles H. Gilbert: List of fishes collected at Mazatlan, Mexico. Bulletin, 1882 (1883), vol. II, p. 105–108. F12–387

Jordan, David Starr, and John Otterbein Snyder: Notes on a collection of fishes from the rivers of Mexico, with descriptions of twenty new pecies. Bulletin, 1899 (1901), vol. XIX, p. 115–147, illus. *Doc. 436 issued Aug. 30, 1899.* F12–22

Woolman, Albert J.: Report on a collection of fishes from the rivers of central and northern Mexico. Bulletin, 1894 (1895), vol. XIV, p. 55–66, pl. *Doc. 279 issued May 2, 1894.* 6–10555

CENTRAL AMERICA.

Evermann, Barton Warren, and Edmund Lee Goldsborough: A report on fishes collected in Mexico and Central America, with notes and descriptions of five new species. Bulletin, 1901 (1902), vol. XXI, p. 137–159, illus. *Doc. 495 issued May 3, 1902.* 6–37425

Gilbert, Charles H.: List of fishes observed at Punta Arenas, on the Pacific coast of Central America. Bulletin, 1882 (1883), vol. II, p. 112. F12–386

Jordan, David Starr: List of fishes collected at Panama by Charles H. Gilbert. Bulletin, 1882 (1883), vol. II, p. 109–111. F12–330

Jordan, David Starr, and Barton Warren Evermann: A check list of the fishes and fish-like vertebrates of North and Middle America. Report, 1895 (1896), p. 207–584. *Doc. 336 issued Dec. 28, 1896.* F11–199

Jordan, David Starr, and Charles H. Gilbert: Descriptions of nineteen new species of fishes from the Bay of Panama. Bulletin, 1881 (1882), vol. I, p. 306–335. F11–219

SOUTH AMERICA.

Krause, Hans Gunner: The fisheries of the west coast of South America. Report, 1879 (1882), p. 515–522. F17–8

Quelch, J. J.: Fish and fishing in British Guiana. Bulletin, 1893 (1894), vol. XIII, p. 237–240. *Doc. 260 issued June 9, 1894.* F12–183

GREAT BRITAIN.

Fishery Board of Scotland: [English, German, and Latin names of edible British fishes and mollusks.] Bulletin, 1885 (1885), vol. V, p. 80–81.

Fuller, Thomas: Carp in England in the seventeenth century. Bulletin, 1884 (1884), vol. IV, p. 14. F18–204

ASIA.

INDIA.

Day, Francis: The fisheries of India. Report, 1883 (1885), p. 383–413. F17–32

JAPAN.

Baldwin, Charles H.: Notes on the fish and fisheries of Japan. Bulletin, 1884 (1884), vol. IV, p. 352. F18–330

Jordan, David Starr, and Edwin Chapin Starks: List of fishes dredged by the steamer *Albatross* off the coast of Japan in the summer of 1900, with descriptions of new species and a review of the Japanese Macrouridæ. Bulletin, 1902 (1904), vol. XXII, p. 577–630, illus., 8 pl. *Doc. 551 issued Aug. 13, 1904.* F12–51

OCEANICA.

AUSTRALIA.

Dannevig, G. M.: Salmonidæ in Australia. Bulletin, 1885 (1885), vol. V, p. 440–442. F18–502

Whitcombe, W. P.: Notes on the acclimatization of fish in Victoria, Australia. Bulletin, 1884 (1884), vol. IV, p. 31–32. F18–209

HAWAIIAN ISLANDS.

Gilbert, Charles Henry: The deep-sea fishes of the Hawaiian Islands. Bulletin, 1902 (1905), vol. XXIII, pt. II, p. 575–713, illus., pl. 66–101. *Doc. 582 issued Aug. 5, 1905.* F11–390

Jenkins, Oliver Peebles: Descriptions of new species of fishes from the Hawaiian Islands, belonging to the families of Labridæ and Scaridæ. Bulletin, 1899 (1901), vol. XIX, p. 45–65, illus. *Doc. 433 issued Aug. 30, 1900.* F12–45

—— Descriptions of fifteen new species of fishes from the Hawaiian Islands. Bulletin, 1899 (1901), vol. XIX, p. 387–404, illus. *Doc. 456 issued June 16, 1901.* F20–127

Jenkins, Oliver Peebles: Report on collections of fishes made in the Hawaiian Islands, with descriptions of new species. Bulletin, 1902 (1903), vol. XXII, p. 417–511, illus., IV pl. *Doc. 534 issued July 23, 1903.* F12–73

Jordan, David Starr: The fishes and fisheries of the Hawaiian Islands. A preliminary report, by David Starr Jordan and Barton Warren Evermann. Commercial fisheries of the Hawaiian Islands, by John Nathan Cobb. Report, 1901 (1902), p. 353–499, pl. 21–27. *Doc. 504 issued Oct. 23, 1902.* F11–27

Jordan, David Starr, and Barton Warren Evermann: Descriptions of new genera and species of fishes from the Hawaiian Islands. Bulletin, 1902 (1904), vol. XXII, p. 161–208. *Doc. 523 issued Apr. 11, 1903.* F12–63

——— Descriptions of a new genus and two new species of fishes from the Hawaiian Islands. Bulletin, 1902 (1904), vol. XXII, p. 209–210. *Doc. 525 issued July 9, 1903.* F12–64

——— The shore fishes of the Hawaiian Islands, with a general account of the fish fauna. (Bibliography: p. 28–30.) Bulletin, 1903 (1905), vol. XXIII, pt. 1, p. 1–574, illus., LXXIII pl. (partly col.) fold. map. *Doc. 577 issued July 29, 1905.* 5–36162

Jordan, David Starr, and John O. Snyder: Notes on fishes of Hawaii, with descriptions of new species. Bulletin, 1906 (1907), vol. XXVII, p. 205–218, illus., pl. XII–XIII, col. *Doc. 623 issued Oct. 25, 1907.* 7–35378

Snyder, John Otterbein: A catalogue of the shore fishes collected by the steamer *Albatross* about the Hawaiian Islands in 1902. Bulletin, 1902 (1904), vol. XXII, p. 513–538, 12 pl. *Doc. 546 issued Jan. 19, 1904.* F12–74

PHILIPPINE ISLANDS.

Evermann, Barton Warren, and Alvin Seale: Fishes of the Philippine Islands. (Bibliography: p. 107–110.) Bulletin, 1906 (1907), vol. XXVI, p. 49–110, illus. *Doc. 607 issued Jan. 11, 1907.* F11–61

Jordan, David Starr, and Robert Earl Richardson: Fishes from islands of the Philippine Archipelago. Bulletin, 1907 (1908), vol. XXVII, p. 233–287, illus. *Doc. 640 issued Dec. 16, 1908.* 8–35768

Jordan, David Starr, and Alvin Seale: Fishes of the islands of Luzon and Panay. Bulletin, 1906 (1907), vol. XXVI, p. 3–48, illus. *Doc. 606 issued Jan. 11, 1907.* F11–60

Smith, Hugh McCormick: Notes on five food fishes of Lake Buhi, Luzon, Philippine Islands. Bulletin, 1901 (1902), vol. XXI, p. 167–171, illus., pl. XXII. *Doc. 501 issued 1902.* F12–277

SAMOA.

Jordan, David Starr: The fishes of Samoa. Descriptions of the species found in the archipelago, with a provisional check-list of the fishes of Oceania. ("Glossary of principal words composing native names of Samoan fishes, by W. E. Safford": p. 446–455.) Bulletin, 1905 (1906), vol. XXV, p. 173–455, XXX p., illus., pl. XXXIII–LIII (partly col.). *Doc. 605 issued Dec. 15, 1906.* F11–70

Safford, William Edward: [Glossary of principal words composing native names of Samoan fishes.] Bulletin, 1905 (1906), vol. XXV, p. 446–455.

OCEANS.

ATLANTIC OCEAN.

U. S. Bureau of Fisheries: List of collections made by the fishing vessels of Gloucester and other New England seaports for the U. S. Fish commission, from 1877 to 1880. The fishes included in the list were identified by G. Brown Goode and T. H. Bean. Report, 1879 (1882), p. 787–835. F17–23

BERING SEA.

Gilbert, Charles Henry: The ichthyological collections of the U. S. Fish commission steamer *Albatross* during the years 1890 and 1891. Report, 1893 (1895), p. 393–476, pl. 20–35. *Doc. 326 issued Dec. 8, 1896.* F16–222

Gilbert, Charles Henry, and Charles Victor Burke: Fishes from Bering Sea and Kamchatka. Bulletin, 1910 (1912), vol. XXX, p. 31–96, illus. *Doc. 754 issued May 6, 1912.* F12–93

PACIFIC OCEAN.

Evermann, Barton Warren, and **Seth Eugene Meek**: A report upon salmon investigations in the Columbia River basin and elsewhere on the Pacific coast in 1896. Bulletin, 1897 (1898), vol. XVII, p. 15–84, illus., 2 pl. *Doc. 352 issued Jan. 6, 1898.* F12–241

Gilbert, Charles Henry: The ichthyological collections of the U. S. Fish commission steamer *Albatross* during the years 1890 and 1891. Report, 1893 (1895), p. 393-476, pl. 20–35. *Doc. 326 issued Dec. 8, 1896.* F16–222

——— Report on fishes obtained by the steamer *Albatross* in the vicinity of Santa Catalina Island and Monterey Bay. Report, 1898 (1899), p. 23–29. *Doc. 400 issued Mar. 22, 1899.* F11–112

Jordan, David Starr, and **R. C. McGregor**: List of fishes collected at Revillagigedo Archipelago and neighboring islands. Report, 1898 (1899), p. 271–284. *Doc. 404 issued Mar. 22, 1899.* F11–116

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Goode, George Brown: The status of the United States Fish commission in 1884. A review of what has been accomplished in fish-culture, and the investigation of the American fisheries. Report, 1884 (1886), p. 1139–1180. *Doc. 75 issued Aug. 9, 1884.* F11–272

McDonald, Marshall: Memorandum of some results of fish-culture already attained. Bulletin, 1884 (1884), vol. IV, p. 261–262. F18–306

——— Report of the division of distribution of the United States Fish commission for the year 1883. Report, 1883 (1885), p. 1051–1087, tables. F17–38

——— Report on the distribution of fish and eggs by the U. S. Fish commission for the season of 1885–86. Bulletin, 1886 (1887), vol. VI, p. 385–394. F18–617

——— Report of the distribution of fish and eggs by the United States Fish commission from January 1, 1886, to June 30, 1887. Report, 1886 (1889), p. 833–842.

——— Address of the chairman of the general committee of the World's Fisheries Congress. Bulletin, 1893 (1894), vol. XIII, p. 15–16. F12–183

Page, William F.: The most recent methods of hatching fish eggs. Bulletin, 1888 (1890), vol. VIII, p. 207–218. F11–321

Smiley, Charles Wesley: [Tables of distribution of fish and fish-eggs. Nos. I–X.] Report, 1881 (1884), p. LXIII–LXVI.

——— A statistical review of the production and distribution to public waters of young fish, by the U. S. Fish commission, from its organization in 1871 to the close of 1880. Report, 1881 (1884), p. 825–915 incl. tables. F16–345

——— Index to the distribution, made under the auspices of the United States Fish commission, of fish in public waters of the United States, during the decade ending 1880. Report, 1881 (1884), p. 917–1035. F16–344

Titcomb, John W.: Fish-cultural practices in the United States Bureau of Fisheries. Bulletin, 1908 (1910), vol. XXVIII, p. 697–757, pl. LXXVII–LXXXIX, diagrs. *Doc. 675 issued Apr. 25, 1910.* 10–35554

U. S. Bureau of Fisheries: Directions for using blanks for recording the propagation and distribution of fish. Report, 1873–74 and 1874–75 (1876), p. 563–568. F16–30

——— Memorandum of some results of the artificial propagation and planting of fish (German whitefish, Maine salmon, rainbow trout, shad, carp, catfish) due mainly to the efforts of the U. S. Fish commission. Bulletin, 1881 (1882), vol. I, p. 208–215, pl. XVII. F18–41

——— Report of the distribution of fish and eggs by the U. S. Fish commission from July 1, 1887, to June 30, 1888. Report, 1887 (1891), p. 363–370. F16–85

——— Observations upon fishes and fish-culture. Bulletin, 1890 (1892), vol. X, p. 49–61. *Doc. 188 issued June 20, 1892.* F12–135

——— Report of distribution of fish and eggs from July 1, 1888, to June 30, 1889. Report, 1888–89 (1892), p. 379–394. *Doc. 179 issued Dec. 3, 1892.* F12–221

——— Report on the propagation and distribution of food-fishes. Report, 1893 (1895), p. 78–138; 1895 (1896), p. 6–72; 1896 (1898), p. 11–92; 1897 (1898), p. XVIII–XC; 1898 (1899), p. XXXI–CXXII; 1899 (1900), p. XXXV–CXVIII, pl. VIII–XXIX; 1900 (1901), p. 25–118; 1901 (1902), p. 21–110, illus., pl. 4–5; 1902 (1904), p. 22–110; 1903 (1905), p. 29–74; 1904 (1905), p. 25–80; 1905 (1907), 64 p., *Doc. 602 issued Oct. 1, 1906;* 1906 (1908), 78 p., *Doc. 613 issued Mar. 12, 1907;* 1907 (1909), 78 p., *Doc. 630 issued Feb. 4, 1908;* 1908 (1910), 93 p., *Doc. 644 issued Mar. 6, 1909;* 1909 (1911), 103 p., *Doc. 728 issued Feb. 12, 1910;* 1910 (1911), 112 p., *Doc. 740 issued June 1, 1911;* 1912 (1914), 108 p., *Doc. 770 issued Mar. 31, 1913;* 1913 (1914), 122 p., *Doc. 794 issued June 13, 1914;* 1914 (1915), 114 p., *Doc. 808 issued Feb. 23, 1915;* 1915 (1917), 138 p., *Doc. 828 issued Mar. 4, 1916;* 1916 (1917), 111 p., *Doc. 837 issued Feb. 26, 1917;* 1917 (1919), 99 p., *Doc. 846 issued Feb. 1, 1918;* 1918 (1920), 82 p., *Doc. 863 issued Oct. 11, 1919;* 1919 (1921), 76 p., *Doc. 878 issued Sept. 9, 1920.*

——— A manual of fish-culture, based on the methods of the United States Commission of fish and fisheries. (*Contents.*—Introduction, by J. J. Brice. The salmons of the Pacific coast, by L. Stone. The Atlantic and landlocked salmons, by C. G. Atkins. The rainbow trout, by G. A. Seagle. The brook trout, by F. N. Clark. The lake trout, by F. N. Clark. The whitefish, by J. J. Stranahan. The shad, by S. G. Worth. The black basses, crappies, and rock bass, by W. F. Page.

The miscellaneous fresh-water fishes. The cod. The common mackerel. The flatfish or winter flounder. Miscellaneous salt-water fishes. The American lobster, by H. M. Smith. The transportation of fish and fish eggs, by J. F. Ellis. Spawning seasons of fishes propagated, character of fish eggs, period of incubation, etc. Notes on the edible frogs of the United States and their artificial propagation, by F. M. Chamberlain. Oysters and methods of oyster-culture, by H. F. Moore. Notes on clam-culture.) Report, 1897 (1898), 340 p., illus., pl. 1-62, I-XVIII. *Doc. 345 issued Nov. 1, 1897.* F11-119

U. S. Bureau of Fisheries: A manual of fish-culture, based on the methods of the U. S. Commission of fish and fisheries, with chapters on the cultivation of oysters and frogs. Revised edition, 340 p., illus., pl. 1-64, I-XVIII. [Additions—The graylings, by J. A. Henshall. The pike perch or wall-eyed pike, by J. J. Stranahan.] *Doc. 345 issued Oct. 17, 1900.* F11-119

U. S. Commissioner of Fisheries: (Propagation and distribution of food fishes.) Report, 1872 and 1873 (1874), p. XVI-XXXI; 1873-1875 (1876), p. XV-XLVI; 1875-76 (1878), p. 8-50; 1877 (1879), p. 18-48; 1878 (1880), p. XXV-XLV; 1879 (1882), p. XXVII-LI; 1880 (1883), p. XXVII-XXXVI; 1881 (1884), p. XLII-LVI; 1882 (1884), p. LV-LXXXIV; 1883 (1885), p. LXXI-XCI; 1884 (1886), p. XLVI-LXVI; 1885 (1887), p. LXXII-CIV; 1886 (1889), p. XXVII-XLIV; 1887 (1891), p. XIII-LII; 1888-89 (1892), p. XVIII-XXXVII; 1889-1891 (1893), p. 10-60; 1892 (1894), p. XIV-LXVIII; 1893 (1895), p. 14-16; 1894 (1896), p. 20-80.

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GENERAL.

U. S. Commissioner of Fisheries: [Fish-cultural stations operated, 1913-1919.] Report, 1913 (1914), p. 7-10; 1914 (1915), p. 39-42; 1915 (1917), p. 7-10; 1916 (1917), p. 8-11; 1917 (1919), p. 53-55; 1918 (1920), p. 10-11; 1919 (1921), p. 31-33.

ALASKA.

AFOGNAK.

U. S. Commissioner of Fisheries: [Afognak Bay, River, and Lake, set aside by proclamation of December, 1892, for use of the U. S. Commission of fish and fisheries.] Report, 1893 (1895), p. 8.

——— [Completion of station.] Report, 1908 (1910), p. 16.

LITNIK LAKE.

U. S. Commissioner of Fisheries: [Site selected, materials and supplies purchased.] Report, 1907 (1909), p. 9.

QUADRA BAY.

U. S. Commissioner of Fisheries: [Establishment of field station at Quadra Bay.] Report, 1915 (1917), p. 14.

YES BAY.

U. S. Commissioner of Fisheries: [Recommendation for site.] Report, 1905 (1907), p. 18-19.

——— [Establishment of hatchery on Lake McDonald.] Report, 1906 (1908), p. 11.

——— [Completion of station.] Report, 1907 (1909), p. 9.

ARKANSAS: MAMMOTH SPRINGS.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1903 (1905), p. 12.

——— [Purchase of site.] Report, 1904 (1905), p. 14.

CALIFORNIA.

BAIRD.

Stone, Livingston: Account of operations at the McCloud River fish-breeding stations of the U. S. Fish commission, from 1872-1882, inclusive. Bulletin, 1882 (1883), vol. II, p. 217-236. F12-359

——— History of operations at the fish-hatching stations on the McCloud River, California, from the beginning, August, 1872, to October, 1884. Bulletin, 1885 (1885), vol. V, p. 28-31. F18-367

——— Report of operations at the United States salmon-hatching establishment on the McCloud River, California. Report, 1872 and 1873 (1874), p. 168-215; 1873-74 and 1874–75 (1876), p. 437–478; 1875–76 (1878), p. 921–958, illus.; 1877 (1879), p. 797–810; 1878 (1880), p. 741–770; 1879 (1882), p. 695–708, 715–720; 1880 (1883), p. 597–613, 615–621; 1881 (1884), p. 1063–1078, 1079–1083; 1882 (1884), p. 839–850, 851–855; 1883 (1885), p. 989–1006; 1884 (1886), p. 169, 171–176; 1885 (1887), p. 131–140; 1886 (1889), p. 737–745.

Stone, Livingston: Report of operations in California in 1873: Report, 1873–74 and 1874–75 (1876), p. 377–429. F16–21

U. S. Commissioner of Fisheries: [Operations at McCloud River.] Report, 1873–74 and 1874–75 (1876), p. XXII–XXX; 1875–76 (1878), p. 24; 1877 (1879), p. 33–34; 1880 (1883), p. XXIX–XXX; 1882 (1884), p. XXV, LXX–LXXI; 1883 (1885), p. XXIII, LXXXI–LXXXIII; 1884 (1886), p. XVI; 1885 (1887), p. XXIII; 1886 (1889), p. XLI; 1887 (1891), p. XIX; 1888–89 (1892), p. XXXV; 1889–1891 (1893), p. 49–50; 1892 (1894), p. LVII–LVIII; 1893 (1895), p. 117–118; 1894 (1896), p. 49; 1895 (1896), p. 44–45; 1896 (1898), 66–67; 1897 (1898), p. LXVI–LXVII; 1898 (1899), p. XCIII; 1899 (1900), p. XCVI–XCVIII, pl. XXII; 1900 (1901), p. 85–90; 1901 (1902), p. 74–77.

——— [Act of March 2, 1889, appropriates funds for quarters.] Report, 1889–1891 (1893), p. 49.

BATTLE CREEK.

U. S. Commissioner of Fisheries: [Establishment of station.] Report, 1897 (1898), p. LXVII–LXIX.

——— [Act, 1898, authorizing permanent station.] Report, 1899 (1900), p. XXIX.

——— [Operations at Battle Creek.] Report, 1898 (1899), p. XCX–XCVII; 1899 (1900), p. XCVIII–C; 1900 (1901), p. 90–91; 1902 (1904), p. 77–78.

CROOKS CREEK.

U. S. Commissioner of Fisheries: [Establishment of Crooks Creek station.] Report, 1879 (1882), p. XXX–XXXI.

——— [Operations at Crooks Creek station.] Report, 1880 (1883), p. XXX.

FORT GASTON.

U. S. Commissioner of Fisheries: [Operations at Fort Gaston station.] Report, 1889–91 (1893), p. 51–52; 1892 (1894), p. LVIII–LIX; 1893 (1895), p. 119–120; 1894 (1896), p. 49–50; 1895 (1896), p. 46–47; 1896 (1898), p. 67–68; 1897 (1898), p. LXXIII; 1898 (1899), p. XCVII–XCVIII.

KORBEL.

U. S. Commissioner of Fisheries: [Operations at Korbel.] Report, 1894 (1896), p. 50; 1895 (1896), p. 47–48.

MILL CREEK.

U. S. Commissioner of Fisheries: [Operations of station.] Report, 1902 (1904), p. 74–75.

COLORADO: LEADVILLE.

U. S. Commissioner of Fisheries: [Operations at Leadville.] Report, 1888–89 (1892), p. XXXV; 1889–1891 (1893), p. 47–49; 1892 (1894), p. LV–LVII; 1893 (1895), p. 114–117; 1894 (1896), p. 47–48; 1895 (1896), p. 42–44; 1896 (1898), p. 62–65; 1897 (1898), p. LXIII–LXV; 1898 (1899), p. LXXXVIII–XC; 1899 (1900), p. LXXXIX–XCI; 1900 (1901), p. 79–81; 1901 (1902), p. 69–71; 1902 (1904), p. 65–67.

DISTRICT OF COLUMBIA.

ARSENAL.

U. S. Commissioner of Fisheries: [Use of ice pond for carp.] Report, 1878 (1880), p. XLII; 1879 (1882), p. XXXVII; 1880 (1883), p. XIX; 1881 (1884), p. XVII; 1882 (1884), p. XXV; 1883 (1885), p. XXVI; 1884 (1886), p. XVII; 1885 (1887), p. XXV; 1886 (1889), p. XLIII.

CENTRAL STATION.

Brown, J. E.: [Carp, goldfish, ides, and catfish handled at Central station.] Bulletin, 1884 (1884), vol. IV, p. 309.

McDonald, Marshall: Report of operations at Central station, United States Fish commission. Report, 1882 (1884), p. 879–890, illus., pls.; 1883 (1885), p. 1017–1034, incl. tables, diagr. F16–315

U. S. Commissioner of Fisheries: [Brief mention.] Report, 1881 (1884), XVI–XVII; 1882 (1884), p. XXV; 1883 (1885), p. XXVI; 1884 (1886), p. XVII; 1885 (1887), p. XXIV; 1887 (1891), p. XXVII–XXVIII; 1888–89 (1892), p. XXVI–XXVIII; 1889–1891 (1893), p. 33–35; 1892 (1894), p. XXXV–XXXVII; 1893 (1895), p. 93–96; 1894 (1896), p. 31–33; 1895 (1896), p. 26–27; 1896 (1898), p. 39–40; 1897 (1898), p. XLVII–XLVIII; 1898 (1899), p. LXII–LXIII; 1899 (1900), p. LXII; 1900 (1901), p. 53; 1901 (1902), p. 46–47; 1902 (1904), p. 44–45.

FISH PONDS.

U. S. Commissioner of Fisheries: [Use of Monument lot authorized by Congress.] Report, 1876–77 (1879), p. 43.

——— [Operations at Fish Ponds.] Report, 1878 (1880), p. XL–XLI; 1879 (1882), p. XXXVI; 1880 (1883), p. XIX; 1881 (1884), p. L–LII; 1882 (1884), p. XXV; 1883 (1885), p. XXVI; 1884 (1886), p. LXII–LXIV; 1885 (1887), p. XXIV–XXV; 1886 (1889), p. XXXVIII; 1887 (1891), p. XXVII; 1888–89 (1892), p. XXVIII; 1889–1891 (1893), p. 35; 1892 (1894), p. XXXVII–XXXIX; 1893 (1895), p. 96–97; 1894 (1896), p. 35–36; 1895 (1896), p. 24–25; 1896 (1898), p. 42–44; 1897 (1898), p. XLIX–LI; 1898 (1899), p. LXIV–LXXII; 1899 (1900), p. LXIII–LXV; 1900 (1901), p. 52–53; 1901 (1902), p. 45; 1902 (1904), p. 43.

NAVY YARD.

U. S. Bureau of Fisheries: [Propagation and distribution of shad (*Alosa sapidissima*) in the spring of 1880.] Report, 1880 (1883), p. 655–657.

Wood, William Maxwell: Report of the operations of the Navy Yard shad-hatching station in Washington, D. C., during the season of 1882. Report, 1882 (1884), p. 891–897, pls. F16–321

GEORGIA: COLD SPRING.

U. S. Bureau of Fisheries: [Site donated.] Report, 1899 (1900), p. XXVIII–XXIX.

ILLINOIS: QUINCY.

U. S. Bureau of Fisheries: [Operations at Quincy.] Report, 1888–89 (1892), p. XXX–XXXI; 1889–1891 (1893), p. 44; 1892 (1894), p. XLIX–L; 1893 (1895), p. 108–110; 1894 (1896), p. 45; 1895 (1896), p. 37–38; 1896 (1898), p. 57–59; 1897 (1898), p. LVII; 1898 (1899), p. LXXXV; 1899 (1900), p. LXXXII–LXXXIII; 1900 (1901), p. 71; 1901 (1902), p. 62; 1902 (1904), p. 59.

IOWA.

MANCHESTER.

U. S. Bureau of Fisheries: [Operations at Manchester.] Report, 1897 (1898), p LVII–LVIII; 1898 (1899), p. LXXXII–LXXXV; 1899 (1900), p. LXXXIII–LXXXV; 1900 (1901), p. 72–75; 1901 (1902), p. 62–64; 1902 (1904), p. 60–62.

NORTH M'GREGOR.

U. S. Bureau of Fisheries: [Establishment of rescue station at North McGregor.] Report, 1904 (1905), p. 39.

KENTUCKY: LOUISVILLE.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1912 (1914), p. 64.

——— [Donation of site by State.] Report, 1913 (1914), p. 69.

LOUISIANA: ATCHAFALAYA.

U. S. Commissioner of Fisheries: [Brief mention.] Report, 1918 (1920), p. 10.

MAINE.

Atkins, Charles G.: Memoranda relative to inclosures for the confinement of salmon, drawn from experience at Bucksport, Penobscot River, Maine. Bulletin, 1884 (1884), vol. IV, p. 170–174. F13–92

BOOTHBAY HARBOR.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1902 (1904), p. 16.

——— Work of the Bureau of fisheries and its fish-cultural station at Boothbay Harbor, Me. 1917. [Occasional papers.] F17-186

BUCKSPORT.

U. S. Commissioner of Fisheries: [Operations at Bucksport.] Report, 1872-73 (1874), p. XVIII-XIX; 1873-1875 (1876), p. XXX; 1875-76 (1878), p. 25; 1877 (1879), p. 36; 1878 (1880), p. XXIX; 1879 (1882), p. XXXI; 1880 (1883), p. XXXI; 1881 (1884), p. XLVII; 1882 (1884), p. XXIV; 1883 (1885). p. LXXX; 1884 (1884), p. XVI; 1885 (1887), p. XXIII; 1886 (1889), p. XL; 1887 (1891), p. XVIII.

CRAIG BROOK.

Atkins, Charles G.: Sketch of the Penobscot salmon-breeding establishment. Bulletin, 1884 (1883), vol. II, p. 373-378. F12-374

——— Report on the propagation of Penobscot salmon in 1886-87. Report, 1888-89 (1892), p. 747-749. F20-161

U. S. Commissioner of Fisheries: [Operations at Craig Brook.] Report, 1883 (1885), p. 79-82; 1889-1891 (1893), p. 13-19; 1892 (1894), p. XVIII-XXI; 1893 (1895), p. 79-82; 1894 (1896), p. 21-23; 1895 (1896), p. 12-15; 1896 (1898), p. 17-21; 1897 (1898), p. XXI-XXV; 1898 (1899), p. XLII-XLIV; 1899 (1900), p. XLV-LI; 1900 (1901), p. 36-38; 1901 (1902), p. 29-31; 1902 (1904), p. 29-31.

——— [Establishment of permanent station at Craig Brook.] Report, 1888-1889 (1892), p. XXII-XXIII.

GRAND LAKE STREAM.

Atkins, Charles G.: Report on the collection and distribution of schoodic salmon eggs. Report, 1877 (1879), p. 817-846, pl.; 1880 (1883), p. 633-665, incl. tables; 1882 (1884), p. 863-871; 1884 (1886), p. 181-187; 1885 (1887), p. 145-156; 1886 (1889), p. 751-759.

——— Sketch of the schoodic salmon-breeding establishment. Bulletin, 1882 (1883), vol. II, p. 379-382. F12-375

——— Report on the schoodic salmon work of 1884-1885. Bulletin, 1885 (1885), vol. V, p. 323-324.

U. S. Commissioner of Fisheries: [Operations at Grand Lakes Stream.] Report, 1875-76 (1878), p. 25-26; 1876-77 (1879), p. 37-38; 1878 (1880), p. XXXII-XXXV; 1879 (1882), p. XXXII-XXXIII; 1880 (1883), p. XXXI; 1881 (1884) p. XLVII-XLVIII; 1882 (1884), p. LXIX; 1883 (1885), p. LXXXI; 1884 (1886), p. LVI; 1885 (1887), p. LXXXVI-LXXXVII; 1886 (1889), p. XXXV; 1887 (1891), p. XVII-XVIII; 1888-89 (1892), p. XXI-XXII; 1889-1891 (1893), p. 14-15; 1892 (1894), p. XVII; 1893 (1895), p. 79.

GREEN LAKE.

Atkins, Charles G.: Report on the propagation of Penobscot salmon in 1879-80. Report, 1879 (1882), p. 721-731, incl. tables.

——— Sketch of the Penobscot salmon-breeding establishment. Bulletin, 1882 (1883), vol. II, p. 373-378. F12-374

——— Report on the propagation of Penobscot salmon in 1884-85. Report, 1884 (1886), p. 177-179, tables.

U. S. Commissioner of Fisheries: [Operations at Green Lake.] Report, 1889-1891 (1893), p. 20-22; 1892 (1894), p. XXI-XXII; 1893 (1895), p. 82-86; 1894 (1896), p. 24-26; 1895 (1896), p. 9-12; 1896 (1898), p. 14-16; 1897 (1898), p. XIX-XX; 1898 (1899), p. XL-XLII; 1899 (1900), p. XLIII-XLV; 1900 (1901) p. 34-35; 1901 (1902), p. 28-29; 1902 (1904), p. 26-29.

MARYLAND.

BRYANS POINT.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1892 (1894), p. XXXI–XXXV.

——— [Operations at Bryans Point.] Report, 1893 (1895), p. 92–93; 1894 (1896), p. 30–31; 1895 (1896), p. 28–29; 1897 (1898), p. XLIV–XLV; 1898 (1899), p. LXI–LXII; 1899 (1900), p. LXII–LXIII; 1900 (1901), p. 51; 1901 (1902), p. 44; 1902 (1904), p. 41–42.

DRUID HILL PARK.

U. S. Commissioner of Fisheries: [Use of Druid Hill Park.] Report, 1877 (1879), p. 42–43; 1878 (1880) p. XL; 1879 (1882), p. XXXVII; 1880 (1883), p. XIX.

FORT WASHINGTON.

Babcock, William C.: Report of shad operations conducted at Fort Washington, Md. Report, 1883 (1885), p. 1035–1042 incl. tables; 1884 (1886), p. 189–197 incl. tables, pl. F11–35

McDonald, Marshall: Report of shad propagation on the Potomac River during the season of 1886. Report, 1886 (1889), p. 815–817.

U. S. Commissioner of Fisheries: [Operations at Fort Washington.] Report, 1883 (1885), p. XXVI; 1884 (1886), p. LVIII–LIX; 1885 (1887), p. LXXXIX; 1886 (1889), p. XXXVI; 1887 (1891), p. XXV; 1888–89 (1892), p. XXVI; 1889–1891 (1893), p. 32–33.

HAVRE DE GRACE.

Clark, Frank Nelson: Notes on experiments in penning shad and taking eggs at Battery station, Havre de Grace, Md., in 1883. Report, 1883 (1885), p. 1045–1050. F17–37

Grabill, L. R.: Report of operations at the shad-hatching station on Battery Island, near Havre de Grace, Md., during the season of 1884. Report, 1884 (1886), p. 807–814 incl. tables. F17–36

Hamlen, William: Report of operations at the Battery Island station, Havre de Grace, Md., during the season of 1884. Report, 1884 (1886), p. 199–208 incl. tables.

Low, W. F.: Report of operations at the Havre de Grace, Md., shad-hatching station during the season of 1883. Report, 1883 (1885), p. 1043–1044 incl. tables.

Ravenel, William de Chastignier: [Table of temperatures and densities at St. Jerome Station, Havre de Grace, Md., for the year 1886.] Report, 1886 (1889), p. 768–777.

Taylor, Fred W.: Analysis of artesian-well water from the shad-hatching station at Havre de Grace, Md. Bulletin, 1883 (1883), vol. III, p. 348. F18–145.

U. S. Commissioner of Fisheries: [Operations at Battery Island.] Report, 1878 (1880), p. XXXVI; 1879 (1882), p. XXXV; 1880 (1883), p. XXXII–XXXIII; 1881 (1884), p. L; 1882 (1884), p. LXXIV–LXXVII; 1883 (1885), p. LXXXIV–LXXXV; 1884 (1886), p. LVIII–LIX; 1885 (1887), p. XCI; 1886 (1889), p. LXII; 1887 (1891), p. XXV–XXVI; 1888–89 (1892), p. XXV–XXVI; 1889–1891 (1893), p. 30–31; 1892 (1894), p. XXIX–XXX; 1893 (1895), p. 91; 1894 (1896), p. 29–30; 1895 (1896), p. 22–24; 1896 (1898), p. 37–39; 1897 (1898), p. XLII–XLIV; 1898 (1899), p. LIX–LXI; 1899 (1900), p. LX–LXII; 1900 (1901), p. 49–51; 1901 (1902), p. 43; 1902 (1904), p. 40–41.

——— Report of shad-hatching operations at Battery station, Havre de Grace, Md., season of 1885 and 1887. Bulletin, 1885 (1885), vol. V, p. 401–410; 1886 (1886), vol. VI, p. 361–368; 1887 (1887), vol. VII, p. 95–100 incl. tables. F18–613

——— [Closure of fish hatchery at Havre de Grace, Md.] Report, 1917 (1919), p. 76–78.

NORTH EAST RIVER.

U. S. Commissioner of Fisheries: [Operations.] Report, 1881 (1884), p. L; 1882 (1884), p. LXXVI.

MASSACHUSETTS.

BERKSHIRE.

U. S. Commissioner of Fisheries: [Donation to U. S. Bureau of fisheries of trout-hatching plant by Mrs. Mary A. Scully.] Report, 1917 (1919), p. 55.

GLOUCESTER.

U. S. Commissioner of Fisheries: [Operations at Gloucester.] Report, 1878 (1880), p. XLII–XLIV; 1879 (1882), p. XXXVII–XXVIII; 1887 (1891), p. XV–XVI; 1888–89 (1892), p. XXIII–XXIV; 1889–1891 (1893), p. 22–24; 1892 (1894), p. XXII; 1893 (1895), p. 86–87; 1894 (1896), p. 26–27; 1895 (1896), p. 17–18; 1896 (1898), p. 24–26; 1897 (1898), p. XXX–XXXVIII; 1898 (1899), p. L–LII; 1899 (1900), p. LXXX–LV; 1900 (1901), p. 45–47; 1901 (1902), p. 35–36; 1902 (1904), p. 37–38.

WOODS HOLE.

U. S. Commissioner of Fisheries: [Operations at Woods Hole.] Report, 1884 (1886), p. XV; 1885 (1887), p. LXXVIII; 1886 (1889), p. XXXIX–XL; 1887 (1891), p. XVI–XVII; 1888–89 (1892), p. XXIV–XXV; 1889–1891 (1893), p. 24–28; 1892 (1894), p. XXIV–XXVII; 1893 (1895), p. 88–90; 1894 (1896), p. 27–29; 1895 (1896), p. 18–22; 1896 (1898), p. 27–31; 1897 (1898), p. XXXVI–XXXVII; 1898 (1899), p. LII–LXI; 1899 (1900), p. LVI–LVIII; 1900 (1901), p. 45–47; 1901 (1902), p. 36–38; 1902 (1904), p. 36–37.

——— [Selection and description of site.] Report, 1881 (1884), p. XXXVII–XL.

——— [Congressional action in regard to the Woods Hole station.] Report, 1882 (1884), p. LXI.

——— [Permanent sea-coast station.] Report, 1882 (1884), p. XXXVII–XLI.

——— [Description of Woods Hole.] Report, 1883 (1885), p. LIII–LVI.

MICHIGAN.

Clark, Frank Nelson: Report of operations at the Michigan stations of the U. S. Fish commission for the year 1886–87. Report, 1886 (1889), p. 729–736.

ALPENA.

Clark, Frank N.: Description of the U. S. fish hatchery at Alpena, Michigan. Bulletin, 1882 (1883), vol. II, p. 388.

——— [Report on operations at Alpena.] Report, 1880 (1883), p. 568–572; 1882 (1884), p. 815–817; 1883 (1885), p. 978–979; 1884 (1886), p. 151–167; 1885 (1887), p. 121–129.

——— [Fish-cultural operations at Alpena.]. Report, 1894 (1896), p. 42–43.

U. S. Commissioner of Fisheries: [Operations at Alpena.] Report, 1883 (1885), p. XXV; 1884 (1886), p. XVI; 1885 (1887), p. XXIII; 1886 (1889), p. XLI; 1887 (1891), p. XXII; 1888–89 (1892), p. XXXII; 1889–1891 (1893), p. 42; 1892 (1894), p. XLVI–XLVII; 1895 (1896), p. 35–36; 1896 (1898), p. 54–55; 1897 (1898) p. LVI–LVII; 1898 (1899), p. LXXXI; 1899 (1900), p. LXXX–LXXXI.

——— [Establishment of station.] Report, 1882 (1884), p. XXV.

Worth, Stephen G.: [Operations at Alpena.] Report, 1893 (1895), p. 105–106.

CHARLEVOIX.

U. S. Commissioner of Fisheries: [Substation established.] Report, 1903 (1905), p. 13.

NORTHVILLE.

Clark, Frank Nelson: Account of operations at the Northville fish-hatching station of the United States Fish commission, from 1874 to 1882, inclusive. Bulletin, 1882 (1883), vol. II, p. 355–372, illus. F12–373

——— Report of operations at Northville and Alpena. Report, 1880 (1883), p. 553–596; 1881 (1884), p. 1037–1062; 1882 (1884), p. 813–838; 1883 (1885), p. 975–988; 1884 (1886), p. 151–167 1885 (1887), p. 121–129; 1886 (1889), p. 729–736.

——— Report on distribution of fish and eggs from Northville and Alpena stations for 1885–86. Bulletin, 1886 (1887), vol. VI, p. 395–399. F18–618

U. S. Commissioner of Fisheries: [Purchase of station and all facilities from Clark.] Report, 1880 (1883), p. XXVII.

——— [Operations at Northville.] Report, 1881 (1884), p. XLIV; 1882 (1884), p. LXIV–LXVIII; 1883 (1885), p. LXXVI–LXXVII; 1884 (1886), p. LII–LIII; 1885 (1887), p. LXXVII–LXXIX, LXXXII; 1886 (1889), p. XXXI, XXXII, XXXIII, 1887 (1891), p. XX–XXII; 1888–89 (1892), p. XXXI–XXXII; 1889–1891 (1893), p. 39–42; 1892 (1894), p. XLIII–XLVI; 1893 (1895), p. 103–105; 1894 (1896); p. 40–42; 1895 (1896), p. 33–35; 1896 (1898), p. 52–54; 1897 (1898), p. LV–LVI; 1898 (1899), p. LCCVII; 1899 (1900), p. LXXVII–LXXIX; 1900 (1901), p. 64–70; 1901 (1902), p. 57–61; 1902 (1904), p. 53–58.

MINNESOTA.

DULUTH.

U. S. Commissioner of Fisheries: [Establishment of station.] Report, 1887 (1891), p. XXXIV.

——— [Operations of station at Duluth.] Report, 1888–89 (1892), p. XXXIII–XXXIV; 1889–1891 (1893), p. 43–44; 1892 (1894), p. XLVII–XLIX; 1893 (1895), p. 106–108; 1894 (1896), p. 44; 1895 (1896), p. 36; 1896 (1898), p. 55–56; 1897 (1898), p. LVII–LIX; 1898 (1899), p. LXXXI–LXXXII; 1899 (1900), p. LXXXI-LXXXII; 1900 (1901), p. 70–71; 1901 (1902), p. 60–62; 1902 (1904), p. 58.

HOMER.

U. S. Commissioner of Fisheries: [Site purchased and construction begun.] Report, 1910 (1911), p. 11.

——— [Completion of buildings.] Report, 1912 (1914), p. 65.

MISSISSIPPI: TUPELO.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1902 (1904), p. 15–16.

——— [Purchase of site.] Report, 1903 (1905), p. 13.

——— [Progress of construction.] Report, 1904 (1905), p. 14.

MISSOURI: NEOSHO.

McDonald, Marshall: [Report in reference to the establishment of a fish-cultural station of the U. S. Fish commission in southwest Missouri.] Report, 1887 (1891), p. XXXI–XXXIII.

U. S. Commissioner of Fisheries: [Operations at Neosho.] Report, 1888–89 (1892), p. XXXIV; 1889–1891 (1893), p. 45–47; 1892 (1894), p. L–LIV; 1893 (1895), p. 110–117; 1894 (1896), p. 45–47; 1895 (1896), p. 38–41; 1896 (1898), p. 59–62; 1897 (1898), p. LIX–LXI; 1898 (1899), p. LXXXV–LXXXVII; 1899 (1900), p. LXXXVII–LXXXIX; 1900 (1901), p. 77–79; 1901 (1902), p. 65–66; 1902 (1904), p. 64–65.

MONTANA: BOZEMAN.

U. S. Commissioner of Fisheries: [Establishment of station at Bozeman.] Report, 1893 (1895), p. 7–8.

——— [Brief mention.] Report, 1894 (1896), p. 8; 1895 (1896), p. 2.

——— [Operations at Bozeman.] Report, 1897 (1898), p. LXV–LXVI; 1898 (1899), p. XCI–XCII; 1899 (1900), p. XCI–XCII; 1900 (1901), p. 83–85; 1901 (1902), p. 73–74; 1902 (1904), p. 69–71.

NEW HAMPSHIRE: NASHUA.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1899 (1900), p. XXVII.

——— [Operations at Nashua.] Report, 1900 (1901), p. 42–43; 1901 (1902), p. 34–35; 1902 (1904), p. 34–36.

NEW JERSEY.

DELAWARE RIVER.

U. S. Commissioner of Fisheries: [Operations on Delaware River.] Report, 1892 (1894), p. XXVIII–XXIX; 1893 (1895), p. 90; 1894 (1896), p. 28–29; 1895 (1896), p. 22; 1896 (1898), p. 33–37; 1899 (1900), p. LIX–LX; 1900 (1901), p. 49; 1901 (1902), p. 42–43; 1902 (1904), p. 39–40.

GLOUCESTER CITY.

U. S. Commissioner of Fisheries: [Operations at Gloucester City.] Report, 1885 (1887), p. XCIII–XCIV; 1889–1891 (1893), p. 28–29.

NEW YORK.

CAPE VINCENT.

U. S. Commissioner of Fisheries: [Cape Vincent selected as site.] Report, 1894 (1896), p. 18.

——— [Operations at Cape Vincent.] Report, 1896 (1898), p. 32–33; 1897 (1898), p. XXIX–XXX; 1898 (1899), p. XLVII–L; 1899 (1900), p. LI–LIII; 1900 (1901), p. 47–49; 1901 (1902), p. 38–42; 1902 (1904), p. 38–39.

COLD SPRING HARBOR.

Mather, Fred: Account of eggs repacked and shipped to foreign countries, under the direction of the U. S. Fish commission. Report, 1882 (1884), p. 809–812; 1883 (1885), p. 973–974; 1884 (1886), p. 143–150; 1885 (1887), p. 117–120; 147–150; 1886 (1889), p. 829–831.

——— Report of operations at Cold Spring Harbor, Long Island. Report, 1884 (1886), p. 129–142; 1885 (1887), p. 109–115; 1886 (1889), p. 721–728.

——— Report of the hatching operations at Cold Spring Harbor, New York, during the season of 1884–85, and the distribution in the spring of 1885. Bulletin, 1885 (1885), vol. V, p. 469–472. F18–512

U. S. Commissioner of Fisheries: [Use of State hatchery at Cold Spring Harbor by U. S. Fish commission.] Report, 1883 (1885), p. XIX; 1884 (1886), p. XVI; 1885 (1887), p. XXIII–XXIV; 1886 (1889), p. XLI; 1887 (1891), p. XXVIII; 1888–89 (1892), p. XXV, 1889–1891 (1893), p. 28; 1892 (1894), p. XXVII–XXVIII.

ROSLYN.

Mather, Fred: Report upon the hatching and distribution of Penobscot and land locked, or schoodic, salmon in the spring of 1882. Report, 1882 (1884), p. 873–877.

U. S. Commissioner of Fisheries: [Use of Chapham's establishment for hatching salmon.] Report, 1882 (1884), p. LXVIII–LXIX.

NORTH CAROLINA.

AVOCA.

Milner, James W.: [Work at Avoca station during 1878.] Report, 1878 (1880), p. 617-

Tanner, Zera Luther: [Work of the *Fish Hawk* at Avoca.] Report, 1881 (1884), p. 59–60.

U. S. Commissioner of Fisheries: [Operations at Avoca station.] Report, 1881 (1884), p. XLIX.

EDENTON.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1899 (1900), p. XXIX–XXX.

——— [Operations at Edenton.] Report, 1900 (1901), p. 57–59; 1901 (1902), p. 50–52; 1902 (1904), p. 47–48.

WELDON.

U. S. Commissioner of Fisheries: [Joint operations by State and U. S. Fish commission.] Report, 1884 (1886), p. XLVIII.

OHIO.

PUT-IN BAY.

U. S. Commissioner of Fisheries: [Operations at Put-in Bay.] Report, 1899–1891 (1893), p. 38–39; 1892 (1894), p. XL–XLII: 1893 (1895), p. 100–102; 1894 (1896), p. 37–40; 1895 (1896), p. 31–32; 1896 (1898), p. 49–51; 1897 (1898), p. LIII–LIV; 1898 (1899), p. LXX–LXXXI, pl. XIII–XVI; 1899 (1900), p. LXXI–LXXVI; 1900 (1901), p. 60–63; 1901 (1902), p. 55–57; 1902 (1904), p. 50–53.

SANDUSKY.

U. S. Commissioner of Fisheries: [Use of State hatchery by U. S. Fish commission.] Report, 1888–89 (1891), p. XXIX–XXX; 1889–1891 (1893), p. 37.

OREGON.

BAKER LAKE.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1899 (1900), p. XXIX.

——— [Description of hatchery and operations for 1900.] Report, 1900 (1901), p. 96–97.

——— [Report of operations for 1901.] Report, 1901 (1902), p. 83–84; 1902 (1904), p. 81–82.

CLACKAMAS.

Hubbard, W. F.: Report of the salmon-hatching operations in 1878 at Clackamas hatchery. Report, 1878 (1880), p. 771–772.

Stone, Livingston: Report of operations at the salmon-hatching station on the Clackamas River in 1877. Report, 1877 (1879), p. 783–796. F16–117

U. S. Commissioner of Fisheries: [Establishment of station.] Report, 1878 (1880), p. XXVII.

——— [New station proposed on the Clackamas River, Oregon.] Report, 1886 (1889), p. XLIX.

——— [Operations at Clackamas station.] Report, 1878 (1880), p. XXVII; 1887 (1891), p. XIX–XX; 1888–89 (1892), p. XXXVI–XXXVII; 1889–1891 (1893), p. 52–53; 1892 (1894), p. LIX–LX; 1893 (1895), p. 121–122; 1894 (1896), p. 51; 1895 (1896), p. 48; 1896 (1898), p. 69–70; 1897 (1898), p. LXIX–LXX; 1898 (1899), p. XCVII–C; 1899 (1900), p. XCIII–XCIV; 1900 (1901), p. 91–92; 1901 (1902), p. 78–80; 1902 (1904), p. 75–77.

ROGUE RIVER.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1898 (1899), p. CI–CII.

——— [Operation of station.] Report, 1901 (1902), p. 78.

——— [Station reopened.] Report, 1900 (1901), p. 92–94.

SALMON RIVER.

U. S. Commissioner of Fisheries: [Selection of site for auxiliary station.] Report, 1897 (1898), p. LXX–LXXI.

——— [Operations at Salmon River.] Report, 1898 (1899), p. CI; 1899 (1900), p. XCIV–XCV.

SIUSLAW RIVER.

U. S. Commissioner of Fisheries: [Operation of hatchery near Mapleton, Oreg., by U. S. Fish commission.] Report, 1898 (1899), p. CIV.

UPPER CLACKAMAS.

U. S. Commissioner of Fisheries: [History of station.] Report, 1898 (1899), p. XCIX–C.

——— [Operations of station.] Report, 1899 (1900), p. XCIV.

PENNSYLVANIA: BRISTOL.

U. S. Commissioner of Fisheries: [Use of Pennsylvania State hatchery.] Report, 1898 (1899), p. LIX.

SOUTH CAROLINA: ORANGEBURG.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1912 (1914), p. 64.

——— [Purchase of site.] Report, 1913 (1914), p. 69.

SOUTH DAKOTA: SPEARFISH.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1897 (1898), p. XV.

——— [Purchase of site.] Report, 1898 (1899), p. XXVI.

[Operations at Spearfish.] Report, 1900 (1901), p. 81–83; 1901 (1902), p. 71–72; 1902 (1904), p. 68–69.

TENNESSEE: ERWIN.

U. S. Commissioner of Fisheries: [Act of August 5, 1892, authorizing the establishment of the station.] Report, 1894 (1896), p. 18.
——— [Selection of site.] Report, 1897 (1898), p. XV.
——— [Operations at Erwin.] Report, 1898 (1899), p. LXVII–LXX; 1899 (1900), p. LXIX–LXXI; 1900 (1901), p. 59–60; 1901 (1902), p. 52–53; 1902 (1904), p. 48–49.

TEXAS: SAN MARCOS.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1892 (1894), p. LXIII.
——— [Donation of site.] Report, 1893 (1895), p. 7.
——— [Operations at San Marcos.] Report, 1897 (1898), p. LXI–LXII; 1898 (1899), p. LXXXVII–LXXXVIII; 1899 (1900), p. LXXXV–LXXXVIII; 1900 (1901), p. 76–77; 1901 (1902), p. 67–69; 1902 (1904), p. 62–64.
——— [Closure of hatchery at San Marcos.] Report, 1917 (1919), p. 77–78.
——— [Station reopened.] Report, 1918 (1920), p. 10.

UTAH: SPRINGVILLE.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1914 (1915), p. 75.

VERMONT.

HOLDEN.

U. S. Commissioner of Fisheries: [Purchase of land for auxiliary station.] Report, 1910 (1911), p. 11.

ST. JOHNSBURY.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1893 (1895), p. 6.
——— [Construction of station.] Report, 1894 (1896), p. 2.
——— [Operations at St. Johnsbury.] Report, 1895 (1896), p. 15–17; 1896 (1898), p. 21–24; 1897 (1898), p. XXV–XXIX; 1898 (1899), p. XLV–XLVIII; 1899 (1900), p. XLVIII–LI; 1900 (1901), p. 39–42; 1901 (1902), p. 31–33; 1902 (1904), p. 32–34.

VIRGINIA.

GUNSTON.

U. S. Commissioner of Fisheries: [Operations of barges on the Potomac River in 1881.] Report, 1881 (1884), p. XLIX.

QUANTICO.

U. S. Commissioner of Fisheries: [Operations at Quantico.] Report, 1882 (1884), p. LXXII; 1883 (1885), p. LXXXIII–LXXXIV.

WYTHEVILLE.

McDonald, Marshall: Report of operations at the trout-breeding station at Wytheville, Va., from its occupation in January, 1882, to June 30, 1887. Report, 1885 (1887), p. 103–108; 1886 (1889), p. 793–800. F11-258
U. S. Commissioner of Fisheries: [Operations at Wytheville.] Report, 1898 (1899), p. LXVI–LXVII; 1899 (1900), p. LXVI–LXIX; 1900 (1901), p. 55–57; 1901 (1902), p. 47–50; 1902 (1904), p. 45–47.
——— [Act passed by the Virginia Legislature authorizing transfer of station from State to United States.] Report, 1898 (1899), p. XXVII.
——— [Operations of State hatchery by U. S. Fish commissioner.] Report, 1882 (1884), p. XVIII; 1883 (1885), p. XXV; 1884 (1886), p. XVI; 1885 (1887), p. XXIII; 1886 (1889), p. XLI; 1887 (1891), p. XXII–XXIII; 1888–89 (1892), p. XXIX; 1889–1891 (1893), p. 36–37; 1895 (1896), p. 29–31; 1896 (1898), p. 47–49; 1897 (1898), p. LI–LII.

WASHINGTON.

BIG WHITE SALMON.

U. S. Commissioner of Fisheries: [Operations at Big White Salmon.] Report, 1902 (1904), p. 80–81.

BIRDSVIEW.

U. S. Commissioner of Fisheries: [Purchase of land.] Report, 1911 (1913), p. 62.

BRINNON.

U. S. Commissioner of of Fisheries: [New station operated on the Dusenwallops River.] Report, 1913 (1914), p. 13.

DARRINGTON.

U. S. Commissioner of Fisheries: [Field station established on the Sauk River.] Report, 1913 (1914), p. 13.

DUCKABUSH.

U. S. Commissioner of Fisheries: [Selection of site and completion of buildings.] Report, 1911 (1913), p. 62.

EAGLE CREEK.

U. S. Commissioner of Fisheries: [Operated as auxiliary of Little and Big White Salmon.] Report, 1903 (1905), p. 38.

LITTLE WHITE SALMON.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1897 (1898), p. LXXI–LXXII.

——— [Operations at Little White Salmon.] Report, 1898 (1899), p. CII–CIV; 1899 (1900), p. XCV; 1900 (1901), p. 94–96; 1901 (1902), p. 81–83; 1902 (1904), p. 79–80.

QUILCENE RIVER.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1911 (1913), p. 62.

QUINIAULT LAKE.

U. S. Commissioner of Fisheries: [Location of new field station.] Report, 1915 (1917), p. 8.

SULTAN.

U. S. Commissioner of Fisheries: [Field station established on Elwell Creek.] Report, 1913 (1914), p. 13.

TANNER CREEK.

U. S. Commissioner of Fisheries: [Operated as auxiliary of Little and Big White Salmon.] Report, 1903 (1905), p. 38.

WEST VIRGINIA: WHITE SULPHUR SPRINGS.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1902 (1904), p. 15.

——— [Construction of station.] Report, 1903 (1905), p. 12.

WYOMING: SARATOGA.

U. S. Commissioner of Fisheries: [Selection of site.] Report, 1912 (1914), p. 64.

——— [Purchase of land for site.] Report, 1914 (1915), p. 76.

WORK OF BUREAU'S CARS.

Eastman, Frank S.: Description of the U. S. Fish commission car No. 2, designed for the distribution of young fish. Report, 1882 (1884), p. 39–41, pls.

Ellis, J. Frank: The transportation of fish and fish eggs. Report, 1897 (1898), p. 239–244; also *in* Manual of fish-culture, rev. ed., 1900, p. 239–244.

McDonald, Marshall: Summary of distribution of fish by one car during the past season. Bulletin, 1883 (1883), vol. III, p. 295. F18–138

Stone, Livingston: [California aquarium car.] Report, 1873–74 and 1874–75 (1876), p. 385–390.

U. S. Commissioner of Fisheries: [Car and messenger service.] Report, 1894 (1896), p. 52; 1896 (1898), p. 71; 1897 (1898), p. XIX; 1898 (1899), p. XXXIV–XXXVI; 1899 (1900), p. XLII; 1900 (1901), p. 16; 1901 (1902), p. 9; 1902 (1904), p. 10; 1903 (1905), p. 10; 1904 (1905), p. 6–7; 1905 (1907), p. 8; 1906 (1908), p. 8; 1907 (1909), p. 8.

——— [Description of car No. 1.] Report, 1881 (1884), p. XLII; 1882 (1884), p. XXX; 1883 (1885), p. XXXVI.

——— [Description of car No. 2.] Report, 1882 (1884), p. XXX; 1883 (1885), p. XXXVI.

——— [Constructed in 1884.] Report, 1884 (1886), p. XXIII.

——— [Cars 1, 2, and 3.] Report, 1885 (1887), p. XXXIII–XXXIV.

——— [Trip of car No. 3, to Michigan.] Bulletin, 1885 (1885), vol. V, p. 106.

——— [First use of car for hatching, Lambertville, Pa.] Report, 1885 (1887), p. XCIV.

——— [New transportation car No. 5.] Report, 1899 (1900), p. XXXI.

——— [Car 3 utilized as hatchery on St. Johns River.] Report, 1897 (1898), p. XIX.

FISH CULTURE BY COUNTRIES.

UNITED STATES.

GENERAL.

Blackford, Eugene G.: Opening remarks of the chairman of the fish-cultural section of the Fisheries Congress. Bulletin, 1893 (1894), vol. XIII, p. 191.

Borodine, N.: Statistical review of fish culture in Europe and North America. Bulletin, 1893 (1894), vol. XIII, p. 193–196. *Doc. 254 issued June 9, 1894.* F12–183

Ewart, J. Cosser: [A Scotch view of our methods.] Bulletin, 1885 (1885), vol. V, p. 83.

Harding, Garrick M.: Suggestions to fish culturists. Bulletin, 1881 (1882), vol. I, p. 55–56. F18–17

Hubrecht, Ambrosius Arnold Willem: Fish culture as seen at the London exhibition, with special references to its history, apparatus, and the methods used in the United States. Bulletin, 1883 (1883), vol. III, p. 337–348. F12–397

Malmgren, A. J.: [Fish culture in the United States.] Bulletin, 1883 (1883), vol. III, p. 363–382.

Milner, James W.: The progress of fish culture in the United States. Report, 1872–73 (1874), p. 523–558, pl. XIV–XV. F15–116

Nordqvist, Oscar: Some notes about American fish culture. Bulletin, 1893 (1894), vol. XIII, p. 197–200. *Doc. 255 issued June 9, 1894.* F12–183

Stone, Livingston: Some brief reminiscences of the early days of fish culture in the United States. Bulletin, 1897 (1898), vol. XVII, p. 337–343. *Doc. 391 issued Aug. 8, 1898.* F12–110

Summary of reports for 1878 by State fish commissioners respecting the increase of food fishes by artificial propagation. Report, 1878 (1880), p. 925–943. F16–187

U. S. Bureau of Fisheries: Reports of special conferences with the American fish culturists association and State commissioners of fisheries. Report, 1872 and 1873 (1874), p. 757–773.

ALASKA.

Fassett, Harry Clifford: [The Karluk hatchery.] Bulletin, 1901 (1902), vol. XXI, p. 331–348, illus., pl. XXXII–XXXIV.

ARIZONA.

Evermann, Barton Warren: [Inquiry respecting suitable site for fish-cultural work.] Report, 1904 (1905), p. 109.

CALIFORNIA.

Campbell, J. B.: Notes on McCloud River, California, and some of its fishes. Based upon a letter from J. B. Campbell. Bulletin, 1881 (1882), vol. I, p. 44–46. F18–14

Green, Seth: Rearing of California mountain trout (*Salmo irideus*). Bulletin, 1881 (1882), vol. I, p. 23. F18–11

Poppe, Robert A.: The introduction and culture of the carp in California. Report, 1878 (1880), p. 661–666. F16–173

Titcomb, John W.: [Landlocked salmon, trout, striped bass, and shad in California.] *Quoted by* C. A. Vogelsand. Report, 1903 (1905), p. 33–34.

U. S. Bureau of Fisheries: Hatching and distribution of California salmon. A. Report on California salmon spawn hatched and distributed, by J. H. Slack. B. Hatching and distribution of California salmon in tributaries of Great Salt Lake, by A. P. Rockwood. Report, 1873–74 and 1874–75 (1876), p. 431–435. F16–22

COLORADO.

Titcomb, John W.: [Trout introduced into Colorado.] Report, 1903 (1905), p. 32.

FLORIDA.

Smith, Hugh McCormick: Notes on Biscayne Bay, Florida, with reference to its adaptability as the site of a marine hatching and experiment station. Report, 1895 (1897), p. 169–191. *Doc. 333 issued Jan. 8, 1897.* F11–196

ILLINOIS.

Bartlett, S. P.: [Fish-culture in Illinois.] Bulletin, 1885 (1885), vol. V, p. 107.

IOWA.

Mosher, A. A.: Notes on fish-culture in Iowa. Bulletin, 1885 (1885), vol. V, p. 312. F18–459

MAINE.

Stanley, E. M.: [Work of the Maine commission.] Bulletin, 1885 (1885), vol. V, p. 465.

MICHIGAN.

Post, Hoyt: Fish-culture in Michigan. Bulletin, 1893 (1894), vol. XIII, p. 201–211. *Doc. 256 issued June 26, 1894.* F12–183

MONTANA.

Crosby, John Schuyler: Stocking the streams of Montana with fish. Bulletin, 1883 (1883), vol. III, p. 301–302. F18–140

Henshall, James Alexander: Culture of the Montana grayling. Report and special papers, 1906 (1908), 7 p. *Doc. 628 issued Dec. 11, 1907.* 7–35451

Titcomb, John W.: [Propagation of trout in Montana.] Report, 1903 (1905), p. 32.

NEW JERSEY.

Mason, Harry W.: Report of operations on the Naversink River, New Jersey, in 1879, collecting living striped bass for transportation to California. Report, 1879 (1882), p. 663–666. F17–15

Titcomb, John W.: [Propagation of black bass in New Jersey.] Report, 1903 (1905), p. 34.

NORTH CAROLINA.

Worth, S. G.: Summary of fish-cultural work in North Carolina. Bulletin, 1885 (1885), vol. V, p. 365–367. F18–481

OREGON.

Dowell, B. F.: [Fish-culture in Oregon.] Bulletin, 1884 (1884), vol. IV, p. 469–470.

PENNSYLVANIA.

Titcomb, John W.: [Propagation of rainbow trout in Pennsylvania.] Report, 1903 (1905), p. 34.

SOUTH DAKOTA.

Titcomb, John W.: [Trout in South Dakota.] Report, 1903 (1905), p. 32.

VERMONT.

Stone, L.: [Decline in fish hatching in Vermont.] Bulletin, 1885 (1885), vol. V, p. 351.

WYOMING.

Evermann, Barton W.: [Results of stocking the waters of Yellowstone national park with fish.] Bulletin, 1891 (1893), vol. XI, p. 53–55.

Maynard, H. J.: [Fish-culture in Wyoming Territory.] Bulletin, 1885 (1885), vol. V, p. 107–108.

PACIFIC COAST.

Dunn, Horace D.: [Fish-culture on the Pacific coast.] Bulletin, 1887 (1889), vol. VII, p. 49–50.

CANADA.

Malmgren, A. J.: [Fish-culture in Canada.] Bulletin, 1883 (1883), vol. III, p. 363–382.

MEXICO.

LaMotte, Alfred V.: Commission de Piscicultura de La Republica Mexicana. Bulletin, 1884 (1884), vol. IV, p. 124. F18–243

EUROPE.

GENERAL.

Bettoni, Eugenio, and Decio Vinciguerra: On the fish-cultural establishments of central Europe. Report, 1886 (1889), p. 539–601. F17–147

Borodine, N.: Statistical review of fish-culture in Europe and North America. Bulletin, 1893 (1894), vol. XIII, p. 193–196. *Doc. 254 issued June 9, 1894.* F12–183

Bouchon-Brandely, Germain: Report on the state of pisciculture in France and the neighboring countries. Report, 1872 and 1873 (1874), p. 513–523. F15–115

Haime, Jules: The history of fish-culture in Europe from its earliest records to 1854. Report, 1872 and 1873 (1874), p. 465–492. F15–113

Raveret-Wattel, C.: Report on the condition of pisciculture in foreign countries from documents collected at the International fishery exposition at Berlin, 1880. Report, 1880 (1883), p. 477–489. F16–295

AUSTRIA.

Gasch, Adolf: Pond-cultivation on the Kaniow estate (District of Biala, Galicia), the property of his imperial highness, Archduke Albrecht of Austria. Report, 1880 (1883), p. 533–543. F16–282

Malmgren, A. J.: [Fish-culture in Austria.] Bulletin, 1883 (1883), vol. III, p. 372–373.

Marenzeller, Emil, edler von: The piscicultural establishment of Mr. August Fruwirth in Freiland near St. Polten, Lower Austria. Report, 1879 (1882), p. 651–660, illus. F17–14

Peyrer, Karl: [Artificial fish breeding.] Report, 1873–74 and 1874–75 (1876), p. 580–585.

Swetitsch, Joseph: A depot for embryonated eggs of all the valuable kinds of fish. Bulletin, 1881 (1882), vol. I, p. 345–346.

Wengen, von der: [Artificial fish-culture in Austria.] Report, 1884 (1886), p. 454.

BELGIUM.

Fry planted in rivers of Belgium in 1886. Bulletin, 1886 (1887), vol. VI, p. 258–263. F18–587

Selys-Longchamps, Edmond, i. e., Michel Edmond Selys de, baron: Repopulation of the water-courses in Belgium. Report, 1881 (1884), p. 815–824. F16–343

Willequet, E.: Fish-culture in Belgium. Bulletin, 1883 (1883), vol. III, p. 218–220. F12–391

——— Fish-culture in Belgium—Proposed government action. Bulletin, 1883 (1883), vol. III, p. 437–439. F18–168

DENMARK.

Wengen, von der: [Fish-culture in Denmark.] Report, 1884 (1886), p. 458.

FINLAND.

Malmgren, A. J.: Memorial addressed to the Bureau of agriculture of the Imperial senate for Finland, January 20, 1883, in regard to the advisability of introducing artificial fish culture in Finland. Bulletin, 1883 (1883), vol. III, p. 363–382. F12–309

Wengen, von der: [Question of fish-culture in Finland.] Report, 1884 (1886), p. 437–438.

FRANCE.

Bouchon-Brandely, Germain: Report on the state of pisciculture in France and the neighboring countries. Report, 1872–73 (1874), p. 513–523. F15–115

Causans, Viscount de: The fish-cultural establishment of Lake Saint-Front, Haute Loire, France. Bulletin, 1885 (1885), vol. V, p. 201–202. F18–408

Chabot-Karlen: [Reports on fish-cultural operations in France, at Beaune, Saint-Remy and Nanteuil-en-Vallen.] Bulletin, 1894 (1895), vol. XIV, p. 309–311.

Ducastel: The transformation of salt marshes into fish ponds. Report, 1880 (1883), p. 517–531, illus. F16–279

Halloy, Leon d': Fish-culture at Gouville, France. Bulletin, 1885 (1885), vol. V, p. 255–256. F18–425.

Malmgren, A. J.: [Fish-culture in France.] Bulletin, 1883 (1883), vol. III, p. 369.

Raveret-Wattel, C.: The piscicultural establishment at Gremaz (Ain), France. Bulletin, 1887 (1889), vol. VII, p. 207–211. F18–670

Wengen, von der: [Fish-culture in France.] Report, 1884 (1886), p. 442–443. F17–135

GERMANY.

Bavarian Fishery Association: [Course of instruction.] Bulletin, 1895 (1896), vol. XV, p. 321–324.

Behr, Friedrich von: [Address made at the meeting of the German fishery association at Berlin, March 16, 1877, by Mr. Von Behr, Schmoldow, president of the association, member of the German parliament.] Report, 1875–76 (1878), p. 1014–1024.

Borne, Max von dem: How can our lakes and rivers be again stocked with fish in the shortest possible time? Report, 1873–74 and 1874–75 (1876), p. 681–683. F16–32

——— Distribution of American fish and fish eggs by the German fishery association. Bulletin, 1885 (1885), vol. V, p. 261–264.

Brumme: Great results obtained with little water. Bulletin, 1884 (1884), vol. IV, p. 329–331. F13–111

Eben-Bauditten: Recent contributions to pond cultivation. Bulletin, 1881 (1882), vol. I, p. 385–387.

[**Fish-cultural** methods at the agricultural school at Freising.] Bulletin, 1895 (1896), vol. XV, p. 320–321, pl. 55.

Hoffman: [Fish-culture on the Frische-Haff.] Bulletin, 1886 (1887), vol. VI, p. 311–312.

Jaffe, S.: Notes on fish-culture in Germany. Bulletin, 1895 (1896), vol. XV, p. 311–324, illus. *Doc. 304 issued Mar. 5, 1896.* F12–246

Malmgren, A. J.: [Fish-culture in Germany.] Bulletin, 1883 (1883), vol. III, p. 369–372.

Mr. Christian Wagner's establishment for raising goldfish at Oldenberg, Germany. Report, 1878 (1880), p. 679–684. F16–177

Polenz, Chamberlain von: An opinion regarding R. Eckhardt's answer to Professor Malmgren. Bulletin, 1883 (1883), vol. III, p. 387–388. F18–148

Treskow-Weissagk, von: What dangers threaten the products of the old pond carp fisheries from artificial fish culture. Bulletin, 1883 (1883), vol. III, p. 303–304. F18–142

Veckenstedt, Edm.: On the carp ponds of Nether Lusatia. Report, 1878 (1880), p. 671–674. F16–175

Wengen, von der: [Fish-culture in Germany.] Report, 1884 (1886), p. 444–452. F17–135

GREAT BRITAIN.

Duncan, J. Barker: Salmon and trout hatcheries in Scotland. Bulletin, 1885 (1885), vol. V, p. 451–456. F18–508

Exeter, Marquis: [American fish eggs in England.] Bulletin, 1886 (1887), vol. VI, p. 129.

Fulton, T. Wemyss: Description of the marine hatchery at Dunbar, Scotland. Bulletin, 1893 (1894), vol. XIII, p. 257–262. *Doc. 261 issued June 26, 1894.* F12–183

Howietoun fishery: [Fish-culture in Scotland.] Bulletin, 1886 (1887), vol. VI, p. 406.

[The **Howietoun** hatchery in Scotland.] Bulletin, 1885 (1885), vol. V, p. 83–84.

Malmgren, A. J.: [Fish-culture in England, Scotland, and Ireland.] Bulletin, 1883 (1883), vol. III, p. 374–375.

Manley, J. J.: Pisciculture in England. Bulletin, 1884 (1884), vol. IV, p. 69–74. F13–83

McIntosh, W. C.: Fish-cultural investigations at St. Andrews Marine Laboratory, Scotland. Bulletin 1893 (1894), vol. XIII, p. 241–256. *Doc. 261 issued June 26, 1894.* F12–183

Wengen, von der: [Fish-culture in England.] Report, 1884 (1886), p. 454–455.

ICELAND.

Thorarinsson, Bened. S.: Notes on the hatcheries and fresh-water fisheries of Iceland. Bulletin, 1887 (1889), vol. VII, p. 120–126. F18–661

ITALY.

Pavesi, Pietro: Notes on hatching and planting young fish in Italian waters. Bulletin, 1886 (1887), vol. VI, p. 263–265. F18–588

NORWAY.

Dannevig, Gunder Mathisen: Report of operations at the hatching establishment for marine fishes, Arendal, 1884. Bulletin, 1885 (1885), vol. V, p. 154–160. F18–395

——— Artificial hatching of salt-water fish and lobsters in Norway. Bulletin, 1885 (1885), vol. V, p. 437–440. F18–501

——— The utility of sea-fish hatching. Bulletin, 1908 (1910), vol. XXVII, p. 811–816. *Doc. 681 issued April, 1910.* 10–35424

Landmark, Anthon, i. e. Even Anthon Thomas: [Concerning the desirability of a hatchery for salt-water fish in Norway.] Bulletin, 1885 (1885), vol. V, p. 146–147.

Malmgren, A. J.: [Fish-culture in Norway.] Bulletin, 1883 (1883), vol. III, p. 375–376.

Rasch, Halvor Heyerdahl; A. Landmark; and G. O. Sars: Opinions concerning the desirability of a hatchery for salt-water fish in Norway. Bulletin, 1885 (1885), vol. V, p. 146–151. F18–392

Sars, George Ossian: [Opinion concerning the desirability of a hatchery for salt-water fish in Norway.] Bulletin, 1885 (1885), vol. V, p. 148–149.

Wengen, von der: [Fish-culture in Norway.] Report, 1884 (1886), p. 456–458.

Wergeland, N.: The economical value of the Norwegian Lakes and rivers as a field for fish-culture. Report, 1878 (1880), p. 539–604. F16–169

RUSSIA.

Leach, Glen C., and Nicolas A. Borodin: Artificial propagation of sturgeon. Review of sturgeon culture in the United States, by Glen C. Leach, and Artificial propagation of sturgeon in Russia, by Nicolas A. Borodin. Appendix III, Report, 1919 (1921), 7 p. *Doc. 880 issued Feb. 19, 1920.* F20–1

Malmgren, A. J.: Memorial address to the Bureau of agriculture of the Imperial senate of Finland, January 20, 1883, in regard to the advisability of introducing artificial fish-culture in Finland. (History of fish-culture in Russia: p. 363–368.) Bulletin, 1883 (1883), vol. III, p. 363–382. F12–309

Soudakevicz, Theodore: Report on the progress of pisciculture in Russia. Report, 1872 and 1873 (1874), p. 493–513. F15–114

Wengen, von der: [Fish-culture in Russia.] Report, 1884 (1886), p. 439–441. F17–135

SPAIN.

Muntadas, F.: Report on the piscicultural establishment of Piedra, Aragon, Spain. Bulletin, 1887 (1889), vol. VII, p. 211–215. F18–671

SWEDEN.

Malmgren, A. J.: [Fish-culture in Sweden.] Bulletin, 1883 (1883), vol. III, p. 376–377.

SWITZERLAND.

[Swiss fish-culture.] Bulletin, 1885 (1885), vol. V, p. 338.

ASIA.

CHINA.

Kopsch, H.: Notes on pisciculture in Kiangsi. Report, 1873–74 and 1874–75 (1876), p. 543–547. F16–27

Seymour, Charles: Fish-culture in southern China. Bulletin, 1885 (1885), vol. V, p. 252–254. F18–423

Shephard, Isaac F.: Fish-culture in China. Bulletin, 1885 (1885), vol. V, p. 250–251. F18–422

Smart, Goldsmith and **Johnson**: A Chinese method of fish-culture. Bulletin, 1884 (1884), vol. IV, p. 88. F18–235

Smithers, E. J.: Carp culture in China. Bulletin, 1885 (1885), vol. V, p. 249–250. F18–421

JAPAN.

Mitsukuri, Kakichi: The cultivation of marine and fresh-water animals in Japan. Bulletin, 1904 (1905), vol. XXIV, p. 257–289, illus. XI pl. *Doc. 573 issued June 17, 1905.* F12–10

Sekizawa, Akekio: Memorandum on fish-culture in Japan, with a notice of experiments in breeding the California trout. Report, 1879 (1882), p. 645–648. F17–12

OCEANICA.

HAWAIIAN ISLANDS.

Cobb, John Nathan: [Fish ponds of the Hawaiian Islands.] Report, 1901 (1902), p. 427–433.

——— [Fish ponds of the Hawaiian Islands.] Bulletin, 1903 (1905), vol. XXIII, pt. II, p. 746–750, pl. 106.

Jordan, David Starr: [Fish ponds of the Hawaiian Islands.] Report, 1901 (1902), p. 374–375.

NEW ZEALAND.

Creighton, R. J.: Fish culture in New Zealand. Bulletin, 1881 (1882), vol. I, p. 51–52. F12–334

Rutherford, Alexander J.: [Fish-culture in New Zealand.] Bulletin, 1886 (1887), vol. VI, p. 463–464.

Seed, William: Fish-culture in New Zealand. Bulletin, 1886 (1887), vol. VI, p. 213–216. F18–579

MALACCA AND STRAITS SETTLEMENTS.

Wray, Leonard: A desire for fish-culture in Malacca. Bulletin, 1885 (1885), vol. V, p. 463–464. F18–510

INTRODUCED SPECIES.

UNITED STATES.

Arrival of German trout eggs, *Salmo fario.*] Bulletin, 1884 (1884), vol. IV, p. 361.

Bean, Tarleton Hoffmann: Report on the proposed introduction of Jamaica mountain mullet into the United States. Bulletin, 1888 (1890), vol. VIII, p. 443–451. F11–326

Blackford, Eugene Gilbert: [Shipment of soles from England to New York.] Bulletin, 1886 (1887), vol. VI, p. 449–450.

Clark, Frank: [Salmon in the Hudson.] *Quoted from* Forest and Stream of June 10, 1886. Report, 1885 (1887), p. 110.

Collins, Joseph William: [Acclimatization of shad on the Pacific coast.] Report, 1888–1889 (1892), p. 11.

[**Coregonus albula** eggs from Germany.] Bulletin, 1885 (1885), vol. V, p. 468.

Davis, H. B.: Gratifying results of propagating German carp. Bream and carp in ponds together. Table qualities of carp. Bulletin, 1882 (1883), vol. II, p. 317–318. F18–109

Dunn, Horace D.: [Fish-culture on the Pacific coast.] Bulletin, 1887 (1889), vol. VII, p. 49–50.

Finsch, Otto: Report on the transportation of a collection of living carp from Germany. Report, 1879 (1882), p. 667–670. F17–16

Gill, Theodore Nicholas: Natural and economical history of the gourami (*Osphromenus goramy*). Report, 1872 and 1873 (1874), p. 710–728. *Doc. 9 issued Jan. 26, 1875.* F11–205

Green, Seth: The introduction of land-locked salmon into Woodhull Lake, New York, and the subsequent capture of some of them. Bulletin, 1881 (1882), vol. I, p. 421. F18–55

Hessel, Rudolph: The carp and its cultivation in rivers and lakes; and its introduction into America. Report, 1875–76 (1878), p. 865–900. *Doc. 27 issued Apr. 20, 1881.* F12–218

——— Arrival of blue carp from Germany. Bulletin, 1883 (1883), vol. III, p. 443. F18–174

Kendall, William Converse: Fishes and fishing in Sunapee Lake. (Introduced fishes: p. 16–18.) Report and special papers, 1912 (1914). *Doc. 783 issued Jan. 28, 1914.* F14–1

Klotz, J. P. J.: [Possibility and usefulness of acclimatization.] Report, 1880 (1883), p. 511–512.

McDonald, Marshall: [Assignments of eggs of brown trout and saibling, season of 1887.] Bulletin, 1887 (1889), vol. VII, p. 34.

Maitland, Sir James Gibson, bart.: Exchange of land-locked salmon eggs from Maine for Lock Leven trout ova from Scotland. Bulletin, 1884 (1887), vol. IV, p. 114.

Mather, Fred: The experiment of transporting turbot and soles from England to America. Report, 1877 (1879), p. 867–973. F16–123

——— Exchange of live marine specimens with France. Bulletin, 1883 (1883), vol. III, p. 472. F18–198

——— Brown trout in America. Bulletin, 1887 (1889), vol. VII, p. 21–22. F18–640

——— Report upon the results of salmon planting in the Hudson River. Bulletin, 1887 (1889), vol. VII, p. 409–424. F18–678

Matte, Paul: [Receipt of paradise fish from Germany.] Bulletin, 1885 (1885), vol. V, p. 85.

Moore, Thomas J.: Report of a successful attempt to introduce living soles in America. Bulletin, 1887 (1889), vol. VII, p. 1–7. F18–634

Phillips, Barnet: Holland carp put into the Hudson River about 1830. Bulletin, 1882 (1883), vol. II, p. 25. F18–70

Pope, Thomas E. B.: Devils Lake, North Dakota. A study of physical and biological conditions with a view to the acclimatization of fish. (Acclimatization experiments: p. 20–21.) Report and special papers, 1907 (1908), 23 cm., 22 p., III pl. *Doc. 634 issued July 16, 1908.* 8–35574

Redding, Joseph D.: Character of the carp introduced by Capt. Henry Robinson about 1830. Bulletin, 1884 (1884), vol. IV, p. 266–267. F18–308

Robinson, W. Russel: A California salmon taken in James River. Bulletin, 1884 (1884), vol. IV, p. 290. F18–314

Shears, E. E.: Carp in the Hudson River. Bulletin, 1881 (1882), vol. I, p. 54–55. F18–16

Smiley, Charles Wesley: Loch Leven trout introduced in the United States. Bulletin, 1887 (1889), vol. VII, p. 28-32. F18-644

Smith, Hugh McCormick: Notes on the capture of Atlantic salmon at sea and in the coast waters of the eastern States. Bulletin, 1894 (1895), vol. XIV, p. 95-99, pl. 3-4. *Doc. 281 issued May 4, 1894.* F12-168

——— A review of the history and results of the attempts to acclimatize fish (catfish, carp, tench, goldfish, awa, shad, whitefish, Atlantic salmon, landlocked salmon. Von Behr trout, Loch Leven trout, lake trout, eastern brook trout, muskellunge, pike, eel, crappies, bass, sunfishes, yellow perch, tautog) in the Pacific States, Bulletin, 1895 (1896), vol. XV, p. 379-472, pl. 73-83. *Doc. 309 issued Apr. 22, 1896.* F11-341

Stowe, William: [An opinion of the sole.] Bulletin, 1885 (1885), vol. V, p. 467.

Throckmorton, S. R].: The introduction of striped bass into California. Bulletin, 1881 (1882), vol. I, p. 61-62. F18-21

U. S. Commissioner of Fisheries: [Attempt to introduce the Gourami.] Report, 1881 (1884), p. LII.

——— [Efforts to introduce sole from England.] Report, 1881 (1884), p. LIII-LV.

——— [Acclimatization of new species.] Report, 1887 (1891), p. LI-LII.

——— [Some results of fish acclimatization.] Report, 1896 (1898), p. 136-143.

——— [Acclimatization of bass and shad on the Pacific coast.] Report, 1905 (1907), p. 15-16.

———[Acclimatization of chinook and Atlantic salmon.] Report, 1910 (1911), p. 12-13.

——— [Acclimatization of humpback salmon in Maine and of steelhead trout in New England.] Report, 1914 (1915), p. 59.

——— [Transfer of humpback salmon to New England.] Report, 1915 (1917), p. 27.

ONTARIO.

Wilmot, Samuel: Introduction of California salmon into Ontario, with remarks on the disappearance of Maine salmon from that province. Bulletin, 1881 (1882), vol. I, p. 347-349. F20-146

CUBA.

Odvards, J. N.: [Carp sent to Cuba.] Bulletin, 1884 (1884), vol. IV, p. 308-309.

MEXICO.

[Carp for Mexico.] Bulletin, 1885 (1885), vol. V, p. 346.

SOUTH AMERICA.

[Carp for South America.] Bulletin, 1885 (1885), vol. V, p. 347.

ARGENTINA.

Tulian, E. A.: Acclimatization of American fishes in Argentina. Bulletin, 1908 (1910), vol. XXVIII, p. 955-965. *Doc. 696 issued April, 1910.* 10-35430

BRAZIL.

[Carp sent to Brazil.] Bulletin, 1884 (1884), vol. IV, p. 309.

Couchman, J. W.: Transporting carp from the United States Fish commission to Brazil. Bulletin, 1882 (1883), vol. II, p. 382. F18-110

CHILE.

Cerda, Juan de la C.: Proposed transmission of salmon eggs to Chili and importation of Chilian species of fishes. Bulletin, 1885 (1885), vol. V, p. 247-248. F18-420

EUROPE.

GENERAL.

Correspondence connected with the transmission of eggs of the Quinnat salmon and other Salmonidæ to European countries in 1878 and prior years. Report, 1878 (1880), p. 907-924. F16-186

Mather, Fred: Account of trip to Europe with eggs of Quinnat salmon. Report, 1877 (1879), p. 811-816. F16-119,

——— Account of eggs repacked and shipped to foreign countries, under the direction of the U. S. Fish commission during the winter of 1882-83. Report, 1883 (1885), p. 809-812. F16-317

——— Account of eggs repacked at Cold Springs Harbor, N. Y., and shipped to foreign countries under the direction of the U. S. Fish commission during the winter of 1884-85. Report, 1884 (1886), p. 147-150.

AUSTRIA.

Franke, Johann: Causes of degeneration of American trouts in Austria. Bulletin, 1908 (1910), vol. XXVII, p, 983-989. *Doc. 699 issued April, 1910.* 10-35428

Pirko, Franz von: Naturalization of American fishes in Austrian waters. Bulletin, 1908 (1910), vol. XXVIII, p. 977-982. *Doc. 698 issued April, 1910.* 10-35429

BELGIUM.

Lefebvre, Alfred: The proposed introduction of American catfish into the rivers of Belgium. Bulletin, 1882 (1883), vol. II, p. 153-154. F18-93

——— [The arrival of catfish in Belgium.] Bulletin, 1885 (1885), vol. V, p. 467.

[**Shipment** of catfish to Belgium.] Bulletin, 1885 (1885), vol. V, p. 84.

Wilson, Thomas: The proposed introduction of catfish into Ghent. Bulletin, 1881 (1882), vol. I, p. 340.

FINLAND.

Nordqvist, Oscar Frithiof: An American fish in Finland. Bulletin, 1894 (1895), vol. XIV, p. 27-28. *Doc. 234 issued Mar. 25, 1894.* F12-179

FRANCE.

American land-locked salmon and lake trout in France. Bulletin, 1884 (1884), vol. IV, p. 76. F18-227

Banmeyer, M.: American lake trout and whitefish in France. Bulletin, 1884 (1884), vol. IV, p. 52. F18-217

Duclos, Gilbert: American silver perch, or calico bass. Bulletin, 1887 (1889), vol. VII, p. 215-216. F18-672

Jousset de Bellesme, Georges Louis Marie Felicien: American catfish in the Trocadero aquarium of Paris. Bulletin, 1886 (1887), vol. VI, p. 257. F18-586

Maslieurat-Lagemard: Acclimatization of *Salmo quinnat* in France. Bulletin, 1884 (1884), vol. IV, p. 144. F18-255

Mather, Fred: Exchange of live specimens with France. Bulletin, 1883 (1883), vol. III, p. 472. F18-198

Notes on the cultivation of fish—mostly American—in France. [Translations of items in the Proceedings of the Societe national d' acclimahation, published in the monthly bulletin of the society.] Bulletin, 1884 (1884), vol. IV, p. 273-281. F18-310

Raveret-Wattel, C.: [American catfish in France.] Bulletin, 1886 (1887), vol. VI, p. 138.

——— [Successful introduction of lake trout (*Salmo namaycush*) in France.] Bulletin, 1884 (1884), vol. V, p. 312-313.

——— American fish being acclimatized in France. Bulletin, 1885 (1885), vol. V, p. 244. F18-418

——— Notes on the culture of American salmon in France. Bulletin, 1885 (1885), vol. V, p. 260. F18-428

——— American fish in France. Bulletin, 1885 (1885), vol. V, p. 423. F18-488

Raveret-Wattel, and Bartet: Reproduction of California salmon in the aquarium of Trocadero. (Tr. by Marshall McDonald.) Bulletin, 1883 (1883), vol. III, p. 207-208. F12-382

Societe Nationale d'Acclimation de France: [Eggs of *Salmo irideus* in France.] Bulletin, 1886 (1887), vol. VI, p. 311.

Valery-Mayot: Acclimatization of *Salmo quinnat* in France. Bulletin, 1884 (1884), vol. IV, p. 138. F18-247

Whitefish, lake trout, and brook trout in France. Bulletin, 1884 (1884), vol. IV, p. 112. F18-238

GERMANY.

Behr, Friedrich von: Five American Salmonidæ in Germany. Bulletin, 1882 (1883), vol. II, p. 237–246. F12–360

Bettoni, Eugenio, and D. Vinciguerra: [Successful experiments in acclimatizing bass in Germany.] Report, 1886 (1889), p. 569.

Borne, Max von dem: The American black bass. Bulletin, 1883 (1883), vol. III, p. 221–224. F12–392

——— Spawning in Germany of the large-mouthed black bass sent from the United States in 1882. Bulletin, 1884 (1884), vol. IV, p. 219. F18–288

——— Report on black bass sent from America to Germany in 1883. Bulletin, 1884 (1884), vol. IV, p. 384. F18–342

——— Distribution of American fish and fish-eggs by the German fishery association. Bulletin, 1885 (1885), vol. V, p. 261–263. F18–429

——— [Spawning of American black bass in Germany.] Bulletin, 1885 (1885), vol. V, p. 341.

——— [Black bass in Germany.] Bulletin, 1885 (1885), vol. V, p. 465.

——— [American catfish in Germany.] Bulletin, 1886 (1887), vol. VI, p. 311.

Discussion at the Dresden conference in 1883, of the kinds of fish eggs to be obtained from the United States. Bulletin 1884 (1884), vol. IV, p. 419–420. F18–354

[**Living** shad on their way to the Weser.] Report, 1873–1875 (1876), p. 330–335.

Mather, Fred: [Voyage to Brenneshaven, Germany, with shad.] Report, 1873–1875 (1876), p. 328–330.

GREAT BRITAIN.

Armistead, A. Wilson: A transfer of leather carp (*Cyprinus carpio*) from the Government ponds at Washington, U. S. A., to Scotland. Bulletin, 1881 (1882), vol. I, p. 341–342. F20–110

[**Carp** and ides sent to England.] Bulletin, 1885 (1885), vol. V, p. 102.

Chambers, W. Oldham: [Fish for England.] Bulletin, 1885 (1885), vol. V, p. 79–80.

——— American fish cultivated by the National fish culture association of England. Bulletin, 1887 (1889), vol. VII, p. 17–19. F18–638

Ffennell, Henry: Hatching American fish at South Kensington, and their introduction to English waters. Bulletin, 1885 (1885), vol. V, p. 273–275. F18–435

——— [American fish eggs in England.] Bulletin, 1885 (1885), vol. V, p. 339-340.

Forest and Stream: [A large American brook trout (*Salvelinus fontinalis*) in England.] Bulletin, 1886 (1887), vol. VI, p. 459.

Hensman, John T.: American black bass placed in the river Nene, England. Bulletin, 1884 (1884), vol. IV, p. 166. F18–261

[**Introducing** catfish into England.] Bulletin, 1885 (1885), vol. V, p. 347–348.

[**Introduction** of the aland or orfe into England.] Bulletin, 1881 (1882), vol. I, p. 218–220. F18–42

Maitland, Sir James Gibson, bart.: Exchange of land-locked salmon eggs from Maine for Loch Leven trout ova from Scotland. Bulletin, 1884 (1884), vol. IV, p. 114. F18–240

Manley, J. J.: American fish introduced in English waters. Bulletin, 1884 (1884), vol. IV, p. 60. F18–222

Zenk, F.: [Sending trout eggs from Germany to England.] Bulletin, 1884 (1884), vol. IV, p. 361.

ITALY.

Besana, Giuseppe: American fishes in Italy. Bulletin, 1908 (1910), vol. XXVIII, p. 947–954. *Doc. 695 issued April, 1910.* 10–35414

NETHERLANDS.

Botemanne, C. J.: California salmon in the Netherlands. Report, 1879 (1882), p. 709–713. F17–20

Kerbert, Coenraad: [Black bass sent to Amsterdam.] Bulletin, 1885 (1885), vol. V, p. 352.

Two species of American fish in the aquarium of the Royal zoological society at Amsterdam. Bulletin, 1886 (1887), vol. VI, p. 197–199. F18–573

NORWAY.

[American trout in Norway.] Bulletin, 1885 (1885), vol. V, p. 349.
Nature: [*Salmo fontinalis* in Norway.] Bulletin, 1886 (1887), vol. VI, p. 453.

SWEDEN.

Trybom, Filip: The tench recommended for cultivation in Sweden. Bulletin, 1886 (1887), vol. VI, p. 209–210. F18–578

SWITZERLAND.

Frey, Emile: Disposition of whitefish eggs sent to Switzerland. Bulletin, 1885 (1885), vol. V, p. 358. F18–474
——— [Whitefish and lake trout eggs sent to Switzerland.] Bulletin, 1886 (1887), vol. VI, p. 129.
Goll, Hermann: The American brook trout recommended for Swiss waters. Bulletin, 1886 (1887), vol. VI, p. 206–208. F18–576

OCEANICA.

AUSTRALIA.

Correspondence connected with the transmission of eggs of the Quinnat salmon and whitefish to Australia and New Zealand, 1877, 1878, and prior years. Report, 1878 (1880), p. 825–905. F16–185
Dannevig, G. M.: Salmonidæ in Australia. Bulletin, 1885 (1885), vol. V, p. 440–442. F18–502
Greenfield, Alfred: Report upon the receipt and hatching of American whitefish ova and planting of the fry in Australia. Bulletin, 1884 (1884), vol. IV, p. 190–191. F18–279
The Melbourne Argus: (Trout and California salmon in Australia.] Bulletin, 1886 (1887), vol. VI, p. 409.
Whitcombe, W. P.: Notes on the acclimatization of fish in Victoria, Australia. Bulletin, 1884 (1884), vol. IV, p. 31–32. F18–209
——— Shipments of whitefish eggs to the Ballarat fish acclimatization society. Bulletin, 1885 (1885), vol. V, p. 329–331. F18–468
Wilson, Samuel: [California salmon successful in Australia.] Bulletin, 1885 (1885), vol. V, p. 466.

NEW ZEALAND.

American birds, animals, and fishes for New Zealanders. Bulletin, 1881 (1882), vol. I, p. 53–54. F18–15
American fish in New Zealand. Bulletin, 1886 (1887), vol. VI, p. 304. F18–601
Ayson, L. F.: Introduction of American fishes into New Zealand. (With discussion by H. Stephenson Smith and Edward E. Prince.) Bulletin, 1908 (1910), vol. XXVIII, p. 967–975. *Doc. 697 issued April, 1910.* 10–35440
Correspondence connected with the transmission of eggs of the Quinnat salmon and whitefish to Australia and New Zealand, 1877, 1878, and prior years. Report, 1878 (1880), p. 825–905. F16–185
Correspondence relating to the exportation of fishes and fish-hatching apparatus to New Zealand . . . A. The shipments made in 1875 to New Zealand. B. The shipments of fish ova in 1876 to New Zealand . . . Report, 1875–76 (1878), p. 959–1003. F16–77
Creighton, R. J.: [Acclimatization of fish from the United States in New Zealand.] Bulletin, 1881 (1882), vol. I, p. 51–52.
Farr, S. C.: Description of a California salmon (Oncorhynchus sp.) found in one of the rivers of New Zealand and identified by Dr. T. H. Bean. Bulletin, 1883 (1883), vol. III, p. 427. F18–161

SANDWICH ISLANDS.

Enders, F. H.: [Carp sent to the Sandwich Islands.] Bulletin, 1884 (1884), vol. IV, p. 308.

TASMANIA.

Allport, Morton: Present stage of the salmon experiment in Tasmania. Report, 1878 (1880), p. 819–823. F16–184

Finn, W.: Can herring live and increase in inclosed waters? Bulletin, 1884 (1884), vol. IV, p. 333–335. F18–325

INDIVIDUAL SPECIES.

ALEWIFE.

Baird, Spencer F.: [Alewife should be propagated.] Report, 1872–73 (1874), p. LIX–LXI.

Bean, Tarlton Hoffman: Movements of young alewives (?) (Pomolobus sp.) in Colorado River, Texas. Bulletin, 1881 (1882), vol. I, p. 69–70. F18–27

——— Report on examination of Clupeoids from carp ponds. Bulletin, 1886 (1887), vol. VI, p. 441–442. F18–626

U. S. Bureau of Fisheries: [Culture of the alewives.] Report, 1897 (1898), p. 186–187; also *in* Manual of fish-culture, rev. ed., 1900, p. 186–187.

BASS.

Arnold, Isaac: Successful propagation of black bass. Bulletin, 1882 (1883), vol. II, p. 113–115. F18–85

Borne, Max von dem: Putting bass into carp ponds. Bulletin, 1885 (1885), vol. V, p. 359. F18–476

Leonard, William L.: [Raising black bass, silver bass, and crappies together.] Bulletin, 1885 (1885), vol. V, p. 465.

Lydell, Dwight: The habits and culture of the black bass. Bulletin, 1902 (1904), vol. XXII, p. 39–44, pl. 8. *Doc. 513 issued Feb. 26, 1903.* F12–57

McDonald, Marshall: [First systematic effort inaugurated at fish ponds for propagation of black bass.] Report, 1892 (1894), p. XXXVIII–XXXIX.

Page, William F.: The propagation of black bass in ponds. Bulletin, 1893 (1894), vol. XIII, p. 229–236. *Doc. 259 issued June 26, 1894.* F12–183

——— The black basses, crappies, and rock bass. Report, 1897 (1898), p. 159–177; also *in* Manual of fish-culture, rev. ed., 1900, p. 147–163.

Sharp, John: The large-mouthed black bass in Utah. Bulletin 1897 (1898), vol. XVII, p. 363–368. *Doc 395 issued Aug. 8, 1898.* F12–110

Smiley, Charles Wesley: Removal of bass from Indiana to North Carolina by the U. S. Fish commission. Bulletin, 1882 (1883), vol. II, p. 116.. F18–86

Smith, Hugh McCormick: [History and results of the attempts to acclimatize bass.] Bulletin, 1895 (1896), vol. XV, p. 449–458, pl. 81–83.

U. S. Bureau of Fisheries: The striped bass. Report, 1897 (1898), p. 185–186; also *in* Manual of fish-culture, rev. ed., 1900, p. 187–190.

U. S. Commissioner of Fisheries: [Small-mouth black bass.] Bulletin, 1885 (1885), vol. V, p. 347.

——— [Black bass spawn for the first time in ponds at Wytheville.] Report, 1888–89, (1892) p. XXIX.

——— [Description of artificial tests used at Wytheville.] Report, 1896 (1898), p. 48.

——— [Culture of black bass at fish ponds.] Report, 1893 (1895), p. 97; 1894 (1896), p. 36; 1895 (1896), p. 25; 1896 (1898), p. 42–44; 1897 (1898) p. 4; 1898 (1899), p. LXIV; 1899 (1900), p. LXIII–LXIV.

BUFFALOFISH.

Farrington, John: [Cultivating buffalofish.] Bulletin, 1885 (1885), vol. V, p. 338.

Mosher, A. A.: Propagating buffalofish. Bulletin, 1885 (1885), vol. V, p. 190. F18–403

U. S. Commissioner of Fisheries: [Experimental propagation of buffalofish.] Report, 1912 (1914), p. 50–51.

CARP.

Baird, Spencer F.: [Advantages of carp as a food fish.] Report, 1877 (1879), p. 40–44.

——— [Description of "Babcock Lake" and first carp culture there.] Report, 1878, (1880), p. XL–XLII.

——— [Danger of confusing pure German carp with the poor hybrids of native waters.] Bulletin, 1884 (1884), vol. IV, p. 305–306.

——— [The carp reared by the U. S. Fish commission in 1878.] Bulletin, 1884 (1884), vol. IV, p. 307–308.

Barnes, A. G.: Growth and spawning of German carp in Alabama. Bulletin, 1881 (1882), vol. I, p. 424–425. F18–56

Behr, Friedrich von: Management of spawning carp. Bulletin, 1883 (1883), vol. III, p. 392. F18–148a

Benecke, Berthold: Utilizing water by fish-culture (carp). Report, 1883 (1885), p. 1101–1131. F11–247

Bettoni, Eugenio: [Carp culture at the fish-cultural establishments of central Europe.] Report, 1886 (1889), p. 565–569.

Borne, Max von dem: Raise carp: Report, 1880 (1883), p. 673–680. F16–274

——— How to raise carp and other pond fish which spawn in summer. Report, 1883 (1885), p. 1133–1142. F11–248

——— A large catch of carp.. Bulletin, 1886 (1887), vol. VI, p. 116. F18–554

Brakeley, John H.: Notes on carp and frog culture. Bulletin, 1885 (1885), vol. V, p. 209–216. F18–409

——— [Time required to hatch carp eggs.] Bulletin, 1885 (1885), vol. V, p. 338.

——— [Time required for hatching carp eggs.] Bulletin, 1886 (1887), vol. VI, p. 135–136.

——— Rapid growth of carp due to abundance of food. Bulletin, 1887 (1889), vol. VII, p. 20. F20–639

[The **Carp** fisheries in the Peetz Lakes.] Report, 1878 (1880), p. 675–678.

Carp in France. Bulletin, 1886 (1887), vol. VI, p. 203–204. F18–574

[**Carp** planted in Arkansas and Red rivers.] Bulletin, 1885 (1885), vol. V, p. 101.

[**Cause** and cure of muddy flavor in fish.] Bulletin, 1884 (1884), vol. IV, p. 305.

Cary, H. H.: Period of incubation of eggs of German carp. Bulletin, 1883 (1883), vol. III, p. 447. F18–179

Cole, Leon Jacob: The German carp in the United States. (Bibliography: p. 637–641.) Report, 1904 (1905), p. 523–641, illus., 111 pl. *Doc. 592 issued Dec. 30, 1905.* F12–327

On the culture of carp. A. On carp ponds, by A. F. B. Carp-culture in East Prussia, by R. Strüvy. C. Carp ponds (from Landwirthschaft und industrie Berlin, 1875, Tr. by C. F. Himes). Report, 1873–74 and 1874–75 (1876), p. 549–558.

Davis, H. B.: Gratifying results of propagating German carp. Bream and carp in ponds together. Table qualities of carp. Bulletin, 1882 (1883), vol. II, p. 317–318. F18–109

Donaldson, R. J.: [Shipment of adult carp to South Carolina.] Bulletin, 1884 (1884), vol. IV, p. 310.

——— Raising carp in rice fields. Bulletin, 1885 (1885), vol. V, p. 283–284. F18–440

Eben-Bauditten: On carp-culture, chiefly in its relation to agriculture. Report, 1878 (1880), p. 667–670. F16–174

Eckardt, George: Carp propagation and blue carp. Bulletin, 1882 (1883), vol. II, p. 168. F18–96

Eckardt-Lübbinchen, R.: Report on the propagation and growth of carp. Report, 1879 (1882), p. 671–673. F17–17

Finsch, Otto: Report on the transportation of a collection of living carp from Germany. Report, 1879 (1882), p. 667–670. F17–16

——— Report on a trip in Germany to secure carp for the United States Fish commission. Bulletin, 1881 (1882), vol. I, p. 220–225. F18–43

Gaines, Kemp: Growth, spawning, and distribution of German carp reared from 20 fish furnished by the U. S. Fish commission, November 29, 1880. Bulletin, 1882 (1883), vol. II, p. 392. F18–111

Gasch, Adolph: Pond-cultivation on the Kaniów estate (District of Biala, Galicia), the property of his imperial highness, Archduke Albrecht of Austria. Report, 1880 (1883), p. 533–543. F16–282

——— Pond culture—The food and spawning of carp. Report, 1883 (1885), p. 1143–1150. F17–41

Gillespie, Samuel: Growth and food of carp. Bulletin, 1882 (1883), vol. II, p. 300. F18–105

Gross, Julius: Description of carp ponds and water gate. Bulletin, 1886 (1887), vol. VI, p. 303–304, illus. F18–600

Hessel, Rudolph: The carp and its culture in rivers and lakes; and its introduction into America. Report, 1875–76 (1878), p. 865–900. *Doc. 27 issued Apr. 20, 1881.* F12–218

——— Notes from the carp ponds. Bulletin, 1885 (1885), vol. V, p. 435. F18–498

Heyser, E.: Growth of mirror carp sent to Georgia by the United States Fish commission. Bulletin, 1882 (1883), vol. II, p. 18. F18–67

Johnson, August, and **A. Marchant**: [Carp wanted in Tasmania.] Bulletin, 1886 (1887), vol. VI, p. 451–452.

Johnson, Samuel: Growth of German carp sent to Savoy, Texas, by the U. S. Fish commission. Bulletin, 1882 (1883), vol. II, p. 14. F18–64

Kabler, N. D.: [Price of carp.] Bulletin, 1884 (1884), vol. IV, p. 366.

Knauthe, Karl: Two fertile cyprinoid hybrids. Bulletin, 1894 (1895), vol. XIV, p. 31–41. *Doc. 234 issued Mar. 24, 1894.* F12–180

Leach, G. C.: The artificial propagation of carp. 19 p., illus. *Economic Circular 39 issued Jan. 18, 1919.* F19–1

Leonhardt, G.: Information concerning the blue carp. Bulletin, 1882 (1883), vol. II, p. 15. F18–66

McClelland, Samuel: [Other fish mistaken for carp.] Bulletin, 1885 (1885), vol. V, p. 347.

McDonald, Marshall: Report on the distribution of carp. Report, 1881 (1884), p. 1121–1126; 1882 (1884), p. 915–942. F16–316

——— Distribution of German carp by the United States Fish commission. Bulletin, 1882 (1883), vol. II, p. 94. F12–349

——— [Carp planted in Rivanna River.] Bulletin, 1885 (1885), vol. V, p. 342.

Macgowan, D. J.: Carp culture in China. Bulletin, 1885 (1885), vol. V, p. 235–241. F18–415

Maryland Commission of Fisheries: Directions concerning the construction of carp ponds. (Condensed from the report of the Maryland Fish commission for 1880). Bulletin, 1883 (1883), vol. III, p. 249–256, illus. F11–312

Medary, Charles S.: [Prices of scale and mirror carp.] Bulletin, 1884 (1884), vol. IV, p. 307.

Metcalf, Martin: [Distinguishing the sex of carp.] Bulletin, 1886 (1887), vol. VI, p. 457.

Morriss, T. W.: Spawning of carp in a small basin, at Brenham, Texas. Bulletin, 1882 (1883), vol. II, p. 27. F18–72

Muth, H. W. C.: [Price-list of carp, goldfish, and silverfish.] Bulletin, 1884 (1884), vol. IV, p. 307.

Nicklas, Carl: Production of young fry of the carp. Bulletin, 1883 (1883), vol. III, p. 401–406. F12–402

Page, George Shepard: [Carp planted in Passaic River.] Bulletin, 1886 (1887), vol. VI, p. 316.

Palmer, B. D.: Carp appear February 7, take the hook, and are excellent eating. Bulletin, 1884 (1884), vol. IV, p. 124. F18–244

Pasco, I. D.: A call for carp from Nevada. Bulletin, 1881 (1882), vol. I, p. 29–30. F18–13

Phillipps, Barnet: Holland carp put into the Hudson River about 1830. Bulletin, 1882 (1883), vol. II, p. 25. F18–70

Pigg, L. H.: [Carp for sale.] Bulletin, 1884 (1884), vol. IV, p. 456.

Poppe, Robert A.: The introduction and culture of the carp in California. Report, 1878 (1880), p. 661–666. F16–173

Progress and results of fish culture. German carp. Bulletin, 1881 (1882), vol. I, p. 396. F20–139

Redding, Joseph D.: Character of the carp introduced by Captain Henry Robinson about 1830 in United States. Bulletin, 1884 (1884), vol. IV, p. 266–267. F18–308

Simmons, Newton: [Carp planted in Tallapoosa River.] Bulletin, 1885 (1885), vol. V, p. 104.

Smiley, Charles W.: Answers to one hundred and eighteen questions relating to German carp. Bulletin, 1883 (1883), vol. III, p. 241–248. F11–312

——— The German carp and its introduction into the United States. Bulletin, 1883 (1883), vol. III, p. 333–336. F11–311

——— Report on the distribution of carp to July 1, 1881, from the young reared in 1879 and 1880. Report, 1882 (1884), p. 943–988 incl. tables. F11–308

——— How to distinguish the sex of carp. Bulletin, 1885 (1885), vol. V, p. 36–37. F18–373

——— Some results of carp culture in the United States. Report, 1884 (1886), p. 657–890. *Doc. 112 issued Dec. 1, 1886.* F11–259

Smith, Hugh McCormick: [Introduction of carp to the Pacific States and Rocky mountain regions.] Bulletin 1895 (1896), vol. XV, p. 393–403, pl. 75.

Smithers, E. J.: Carp culture in China. Bulletin, 1885 (1885), vol. V, p. 249–250. F18–421

Stabler, Edward: Growth and protection of carp from turtles, etc. Bulletin, 1883 (1883), vol. III, p. 127–128. F18–120

Stabrowski, Xaver von: Carp culture in Germany. Bulletin, 1886 (1887), vol. VI, p. 57–59. F18–533

Steedman, I. G. W.: [Stocking streams with carp.] Bulletin, 1885 (1885), vol. V, p. 104.

Stocking the Stettiner Haff with carp. Bulletin, 1882 (1883), vol. II, p. 1–8. F18–59

Stover, E. S.: Rearing carp in alkaline water. Bulletin, 1884 (1884), vol. IV, p. 426–427. F18–355

———— Raising carp in a supposed alkaline water. Bulletin, 1885 (1885), vol. V, p. 427–428. F18–494

Texas farm and ranch: The carp ponds belonging to the State of Texas. Bulletin, 1884 (1884), vol. IV, p. 230–231. F18–293

Treskow-Weissagk: What dangers threaten the products of the old pond carp fisheries from artificial fish culture? Bulletin, 1883 (1883), vol. III, p. 303–304. F18–142

Trybom, Filip, i. e., Arvid Filip: Carp culture in Sweden. Bulletin, 1886 (1887), vol. VI, p. 156–160. F18–565

Van Antwerp, W.: Growth, spawning, edible qualities and manner of cooking German carp received from the U. S. Fish commission in 1880. Bulletin, 1882 (1883), vol. II, p. 300. F18–106

Veckenstedt, Edm.: On the carp ponds of Nether Lusatia. Report, 1878 (1880), p. 671–674. F16–175

Wheeler, L. T.: A new method of protecting the eggs of carp and rearing the young. Bulletin, 1884 (1884), vol. IV, p. 221–222. F18–291

White, C. M.: Ability of carp to endure muddy, slimy, and stagnant water. Bulletin, 1883 (1883), vol. III, p. 444. F18–176

Worth, Stephen G.: Shad hatching and carp culture. Bulletin, 1882 (1883), vol. II, p. 26–27. F18–71

———— The selection of sites and the construction of carp ponds. Bulletin, 1884 (1884), vol. IV, p. 33–37.

Wright, Abel A.: A Georgia carp pond. Bulletin, 1881 (1882), vol. I, p. 68–69.

Yoakum, F. L.: Carp culture in Texas. Bulletin, 1882 (1883), vol. II, p. 28–32. F12–343

Yost, John: Report upon the management of German carp by a Mississippi correspondent. Bulletin, 1882 (1883), vol. II, p. 310. F18–108

Zenk, F.: A German view of American carp culture. (Tr. from the German by Herman Jacobson.) Bulletin, 1885 (1885), vol. V, p. 102–104.

CATFISH.

Anthony, O. C.: [Speckled catfish in North Carolina.] Bulletin, 1886 (1887), vol. VI, p. 404.

Gardner, A. P.: Experiments in the pond culture of trout, suckers, and catfish. Bulletin, 1883 (1883), vol. III, p. 417–430. F18–157

Hay, Naman: [Cultivating catfish.] Bulletin, 1886 (1887), vol. VI, p. 137.

Jones, J. F.: The speckled catfish. Bulletin, 1884 (1884), vol. IV, p. 321–322. F18–323

Jordan, David Starr: Proposed propagation of catfish as a food-fish. Bulletin, 1884 (1884), vol. IV, p. 292. F18–316

Kendall, William Converse: American catfishes: habits, culture, and commercial importance. Report and special papers, 1908 (1910), 39 p., X pl. *Doc. 733 issued Aug. 23, 1910.* 10–35947

Lefebvre, Alfred: The proposed introduction of American catfish into the rivers of Belgium. Bulletin, 1882 (1883), vol. II, p. 153–154. F18–93

McDonald, Marshall: Transferring catfish from the Potomac to the Colorado River, Arizona. Bulletin, 1884 (1884), vol. IV, p. 212. F18–287

Smiley, Charles Wesley: Sending catfish to Europe. Bulletin, 1885 (1885), vol. V, p. 433–435. F18–497

Smith, Hugh McCormick: [Introduction of the catfish to the Pacific States.] Bulletin, 1895 (1896), vol. XV, p. 382–393, pl. 74–75.

Smith, Hugh McCormick, and Leighton G. Harron: Breeding habits of the yellow catfish. Bulletin, 1902 (1904), vol. XXII, p. 149–154. *Doc. 517 issued Mar. 30, 1903.* F12–61

U. S. Commissioner of Fisheries: [Spotted catfish spawn at fish ponds.] Report, 1892 (1894), p. XXXIX.

Willequet, E.: Fish-culture in Belgium. Bulletin, 1883 (1883), vol. III, p. 218–221. F12–391

COD.

The **artificial** raising of cod in America. Bulletin, 1883 (1883), vol. III, p. 428.

Atkins, Charles G.: Report on the artificial propagation of codfish at Woods Hole, Mass., for the season of 1886–87. Report, 1886 (1889), p. 783–791.

Baird, Spencer F.: [Experiments instituted for the artificial propagation of the cod.] Report, 1878 (1880), p. XLIII.

——— [Shipment of young codfish from Woods Hole to Pensacola.] Report, 1886 (1889), p. XXIX.

Carswell, James: Report on the artificial propagation of the codfish at Woods Hole, Mass., for the season of 1885–86. Report, 1886 (1889), p. 779–782.

Collins, William Joseph: [Codfish planted in Cape Cod Bay.] Bulletin, 1886 (1887), vol. VI, p. 411.

Dannevig, G. M.: Hatching lobsters and cod in Norway. Bulletin, 1886 (1887), vol. VI, p. 13–14. F18–526

Dunn, Matthias: Number of eggs in the Gadidæ. Bulletin, 1884 (1884), vol. IV, p. 762. F18–228

Earll, R. Edward: A report on the history and present condition of the shore cod-fisheries of Cape Ann, Mass., together with notes on the natural history and artificial propagation of the species. Report, 1878 (1880), p. 685–740. *Doc. 33 issued Jan. 27, 1881.* F11–221

McDonald, Marshall: Experimental investigations upon cod hatching at Woods Hole, Mass., during the winter of 1880–81. Report, 1881 (1884), p. 1127–1129, illus. F16–437

——— [Cod propagation experiments at Central station.] Report, 1882 (1884), p. 883.

Mather, Fred: [Hatching tomcod.] Bulletin, 1885 (1885), vol. V, p. 467.

Rathbun, Richard: [Incipiency of cod hatching by the fish commission.] Report, 1888–89 (1891), p. XCIII–XCV.

Rognerud, Carl: Hatching cod in Norway. Bulletin, 1887 (1889), vol. VII, p. 113–119. F18–660

Ryder, John Adam: A contribution to the embryography of osseous fishes, with special reference to the development of the cod (*Gadus morrhua*). Report, 1883 (1885), p. 455–605, XII pl. *Doc. 71 issued May 17, 1884.* F11–275

Smith, Hugh McCormick: Notes on the tagging of four thousand adult cod at Woods Hole, Massachusetts. Report, 1901 (1902), p. 193–208. F11–20

Tanner, Zera Luther: [Experiments in cod hatching conducted on *Fish Hawk*.] Report, 1882 (1884), p. 3–4.

Tarr, Ralph Stockman: Return to Gloucester Harbor of the young codfish hatched by the U. S. Fish commission. Bulletin, 1884 (1884), vol. IV, p. 57–58. F18–219

U. S. Bureau of Fisheries: [Circulation methods used in cod hatching.] Report, 1896 (1898), p. 25 .

——— The cod. Report, 1897 (1898), p. 193–207, 222–223; also *in* Manual of fish-culture, rev. ed., 1900, p. 195–209, 224–225.

CRAPPIE.

Bartlett, Sylvester P.: The cultivation of crappies in ponds. Bulletin, 1883 (1883), vol. III, p. 362. F18–146

EELS.

Eels in tanks and ponds. Bulletin, 1886 (1887), vol. VI, p. 91–92. F18–545

Goode, George Brown: [Artificial propagation of the lamprey.] Bulletin, 1882 (1883), vol. II, p. 353.

Hermes, Otto: The propagation of the eel. Report, 1879 (1882), p. 457–462, illus. F17–2

Norny, E. R.: Artificial propagation of rockfish and eels. Bulletin, 1885 (1885), vol. V, p. 315. F18–461

Riddle, George W.: Restocking the Merrimac River with lamprey eels. Bulletin, 1885 (1885), vol. V, p. 320. F18–464

FLOUNDER.

Rathbun, Richard L.: [Little known of the breeding habits of the flounder.] Report, 1889–1891 (1893), p. 161.

U. S. Bureau of Fisheries: The flatfish, or winter flounder. Report 1897 (1898), p. 215–218; also *in* Manual of fish-culture, rev. ed., 1900, p. 217–220.

GOLDFISH.

Clark, Frank N.: [Breeding Japanese goldfish.] Bulletin, 1885 (1885), vol. V, p. 267.

Elliott, Henry W.: [Breeding goldfish.] Bulletin, 1885 (1885), vol. V, p. 467.

Hessel, Rudolph: Notes on the habits of the golden ide (*Idus auratus*). Bulletin, 1885 (1885), vol. V, p. 254–255. F18–424

Kirsch, M.: The gold orfe (*Cyprinus orfus*). A. On the raising of the "gold orfe" (*Cyprinus orfus*), by M. Kirsch. B. Correspondence relating to the golde-orfe, by C. Th. E. v. Siebold. Report, 1873–74 and 1874–75 (1876), p. 559–562. F16–29

Macgowan, Daniel J.: Carp culture in China. Bulletin, 1885 (1885), vol. V, p. 235–240. F18–415

Matsubara, Shinnosuke: Goldfish and their culture in Japan. Bulletin, 1908 (1910), vol. XXVII, p. 381–397, col. pl. XVIII–XXVII. *Doc. 666 issued Feb. 26, 1910.* 10–35172

Mr. Christian Wagner's establishment for raising goldfish, at Oldenberg, Germany. Report, 1878 (1880), p. 679–684. F16–177

Ryder, John Adam: Care of goldfish. Queries of William Rosenstihl, jr., with replies. Bulletin, 1884 (1884), vol. IV, p. 381–382. F18–339

GRAYLING.

Baird, Spencer F.: [Credit for first impregnating and hatching grayling due Martin Metcalf.] Report, 1885 (1887), p. LXXXII.

Henshall, James Alexander: The graylings. *In* Manual of fish-culture, rev. ed., 1900, p. 106–108.

——— Culture of the Montana grayling. Report and special papers, 1906 (1908), 7 p. *Doc. 628 issued Dec. 11, 1907.* 7–35451

Ravenel, William de Chastignier: [Experiments in grayling culture.] Report, 1898 (1899), p. XCII.

HERRING.

Baird, Spencer F.: [Propagation of sea herring of economic importance.] Report, 1877 (1879), p. 44–46.

——— [Experiments in hatching Potomac herring (*Clupei vernalis*).] Report, 1882 (1884), p. LXXVII.

Ewart, J. Cossar: On the natural and artificial fertilization of sea herring eggs. Bulletin, 1884 (1884), vol. IV, p. 193–197. F13–95

——— [Transferring fertilized herring eggs to spawning beds.] Bulletin, 1884 (1884), vol. IV, p. 316.

Ljungman, Axel Vilhelm: Preliminary report for 1873–74 on the herring fisheries on the west coast of Sweden. Report, 1873–74 and 1874–75 (1876), p. 123–168. F16–8

——— The propagation and growth of the herring, with special regard to the coast of Bohuslan. Report, 1878 (1880), p. 639–659. F16–172

Meyer, Heinrich Adolf: Biological observations made during the artificial raising of herrings in the western Baltic. Report, 1878 (1880), p. 629–638. F16–189

U. S. Bureau of Fisheries: [The sea herring.] Report, 1897 (1898), p. 225; also *in* Manual of fish-culture, rev. ed., 1900, p. 227–228.

U. S. Commissioner of Fisheries: [Successful experiment in hatching sea herring by Vinal Edwards.] Report, 1877 (1879), p. 45.

MACKEREL.

Earll, Robert Edward: [Artificial propagation of the Spanish mackerel.] Report, 1880 (1883), p. 416–424.

——— Hatching blackfish and Spanish mackerel. Bulletin, 1884 (1884), vol. IV, p. 415–416. F18–353

Hind, H. G.: [Causes of the alleged annual variations in the number of mackerel observed.] Report, 1881 (1884), p. 125–127.

Kite, J. Alban: Report upon apparatus and facilities needed for hatching Spanish mackerel. Report, 1883 (1885), p. 1095–1100, illus. F17–40

McDonald, Marshall: Spanish mackerel investigations at Cherrystone, Va., during the summer of 1881. Report, 1881 (1884), p. 1131–1133. F16–348

Moore, John Percy: Report on mackerel investigations in 1897. Report, 1898 (1899), p. 1–22. *Doc. 399 issued Mar. 28, 1899.* F11–111

Rathbun, R. L.: [Spawning season of the mackerel.] Report, 1895 (1896), p. 80–81.

Ryder, John A.: Development of the Spanish mackerel (*Cybium maculatum*). Bulletin, 1881 (1882), vol. I, p. 135–173, IV pl. F12–317

U. S. Bureau of Fisheries: [Report on the propagation of mackerel.] Report, 1895 (1896), p. 17; 1896 (1898), p. 26 and 30; 1897 (1898), p. XXXIV and XXXVII; 1899 (1900), p. LVIII.

——— The common mackerel. Report, 1897 (1898), p. 209–213; also *in* Manual of fish-culture, rev. ed., 1900, p. 211–215

——— [The Spanish mackerel.] Report, 1897 (1898), p. 220–222; also *in* Manual of fish-culture, rev. ed., 1900, p. 222–224.

Wood, William Maxwell: Report of operations in hatching Spanish mackerel in Chesapeake Bay by the steamer *Fish Hawk* during the summer of 1883. Report, 1883 (1885), p. 1089–1094, illus. F17–39

MENHADEN.

Goode, George Brown: [Feasibility of artificial culture of American menhaden.] Report, 1877 (1879), p. 100.

McDonald, Marshall: [Menhaden an inshore spawner.] *Quotes* Vinal Edwards. Report, 1892 (1894), p. IX.

Rathbun, Richard: [Important discoveries relating to the spawning habits of the menhaden, made by Vinal Edwards.] Report, 1892 (1894), p. CX.

MULLET.

Hoxie, Walter: Occurrence of mullet in fresh water. Bulletin, 1884 (1884), vol. IV, p. 80. F18–229

Miller, John F.: Proposed introduction of Hawaiian mullet into the United States. Bulletin, 1884 (1884), vol. IV, p. 141–142. F18–250

Moser, Jefferson F.: [Raising mullet in Hawaii.] Report, 1897 (1898), p. CLXIX–CLXX.

Rathbun, Richard: [Propagation of the mullet.] Report on the inquiry respecting food fishes and the fishing grounds. Report, 1888–89 (1892), p. LVIII–LIX.

Ravenel, W. DeC.: Information bearing upon the artificial propagation of mullet. Bulletin, 1887 (1889), vol. VII, p. 197–202. F18–667

PERCH.

U. S. Bureau of Fisheries: [The yellow perch.] Report, 1897 (1898), p. 182–184, also *in* Manual of fish-culture, rev. ed., 1900, p. 184–186.

Worth, Stephen G.: Observations on the hatching of the yellow perch. Bulletin, 1890 (1892), vol. X, p. 331–334. *Doc. 201 issued Sept. 24, 1892.* F12–120

PIKE PERCH.

Stranahan, J. J.: [Preventing the sticking together of adhesive eggs.] Report, 1894 (1896), p. 38–39.

——— The pike perch or wall-eyed pike. *In* Manual of fish-culture, rev. ed., 1900, p. 165–179.

ROCKFISH.

Low, W. F.: [Penning rockfish at Battery station.] Bulletin, 1884 (1884), vol. IV, p. 320.

Mason, Harry W.: Report of operations on the Navesink River, New Jersey, in 1879, in collecting living striped bass for transporting to California. Report, 1879 (1882), p. 663–666. F17–15

Norny, E. R.: On the propagation of the striped bass. Bulletin, 1881 (1882), vol. I, p. 67–68. F18–25

——— A proposed pond for rearing striped bass (*Roccus lineatus*) in Delaware Bay. Bulletin, 1881 (1882), vol. I, p. 260–261. F18–48

——— Artificial propagation of rockfish and eels. Bulletin, 1885 (1885), vol. V, p. 315. F18–461

Rathbun, Richard: [Experiments respecting the spawning of sea bass.] Report, 1889–91 (1893), p. 157.

Throckmorton, S. R.: The introduction of striped bass into California. Bulletin, 1881 (1882), vol. I, p. 61–52. F18–21

U. S. Bureau of Fisheries: [Hatching and planting rockfish.] Bulletin, 1886 (1887), vol. VI, p. 137.

——— [Station provided for cultivation of rockfish at Neosho.] Report, 1887 (1891), p. XXXVII.

U. S. Commissioner of Fisheries: [Successful experiments in hatching striped bass by M. G. Holton.] Report, 1872–73 (1874), p. XLVII.

——— [Striped bass successfully propagated.] Report, 1879 (1882), p. XXXVIII.

——— [Propagation of rockfish at Weldon, N. C.] Report, 1884 (1886), p. XLVIII.

Worth, Stephen G.: The artificial propagation of the striped bass (*Roccus lineatus*) on Albemarle Sound. Bulletin, 1881 (1882), vol. I, p. 174–177. F18–34

——— Report upon the propagation of striped bass at Weldon, N. C., in the spring of 1884. Bulletin, 1884 (1884), vol. IV, p. 225–231. F13–100

——— Prospectus of striped bass operations for the season of 1885. Bulletin, 1885 (1885), vol. V, p. 35–36. F18–371

SALMON.

Allport, Morton: Present stage of the salmon experiments in Tasmania. Report, 1878 (1880), p. 819–823. F16–184

Anderson, John: [Salmon in Scotland and shipments to New Zealand.] Bulletin, 1886 (1887), vol. VI, p. 309.

Atkins, Charles G.: On the salmon of eastern North America, and its artificial culture. Report, 1872–73 (1874), p. 226–337. F15–99

——— Report on the collection and distribution of Penobscot salmon. In 1873–74 and 1874–75. Report, 1873–1875 (1876), p. 485–530, tables. F16–25

——— On the collection of eggs of Schoodic salmon. Report, 1875 and 1876 (1878), p. 910–919; 1877 (1879), p. 817–846; 1878 (1880), p. 789–814; 1880 (1883), p. 633–651; 1882 (1884), p. 863–871; 1883 (1885), p. 1011–1015; 1884 (1886), p. 177–179 and 181–187; 1885 (1887), p. 145–156; 1886 (1889), p. 751–759.

——— Report on an attempt to collect eggs of Sebago salmon in 1878. Report, 1878 (1880), p. 775–787. F16–181

——— Report on the propagation of Penobscot salmon. Report, 1879 (1882), p. 721–731 incl. tables; 1880 (1883), p. 623–631; 1881 (1884) p. 1085–1089, 1091–1105; 1883 (1885), p. 1007–1009; 1884 (1886), p. 177–179; 1885 (1887), p. 141–144; 1886 (1889), p. 747–749.

——— Sketch of the Penobscot salmon-breeding establishment. Bulletin, 1882 (1883), vol. II, p. 373–378. F12–374

——— Sketch of the schoodic salmon-breeding establishment. ("Written by request of Prof. S. F. Baird for the London exhibition, 1883.") Bulletin, 1882 (1883), vol. II, p. 379–382. F12–375

———Memoranda relative to inclosures for the confinement of salmon, drawn from experience at Bucksport, Penobscot River, Maine. Bulletin, 1884 (1884), vol. IV, p. 170–174. F13–92

——— Memoranda on landlocked salmon. Bulletin, 1884 (1884), vol. IV, p. 341–344. F13–112

——— The Penobscot and schoodic salmon work in 1884–1885. Bulletin, 1885 (1885), vol. V, p. 51; 323–324. F18–377

——— Methods employed at Craig Brook station in rearing young salmonoid fishes. Bulletin, 1893 (1894), vol. XIII, p. 221–228. *Doc. 258 issued June 26, 1894.* F12–183

——— [Propagation of salmon at Craig Brook.] Report, 1894 (1896), p. 21.

——— The Atlantic and landlocked salmons. Report, 1897 (1898), p. 27–70; also *in* Manual of fish-culture, rev. ed., 1900, p. 17–60.

Barber, C. H.: Success in raising landlocked salmon. Bulletin, 1884 (1884), vol. IV, p. 87. F18–233

Bean, Tarleton Hoffman: Notes on a shipment by the United States Fish commission of California salmon (*Oncorhynchus chouicha*) to Tanners Creek, Indiana, in 1876. Bulletin, 1881 (1882), vol. I, p. 204–205. F18–38

——— Account of a shipment by the U. S. Fish commission of California salmon-fry (*Oncorhynchus chouicha*) to southern Louisiana, with a note on some collection made at Tickfaw. Bulletin, 1881 (1882), vol. I, p. 205–206. F18–39

——— Artificial propagation of the salmon in Alaskan waters. Bulletin, 1889 (1891), vol. IX, p. 207–208.

Bettoni, Eugenio, and Decio Vinciguerra: [Salmon and trout culture in Europe.] Report, 1886 (1889), p. 539–565.

Bottemanne, C. J.: Penning of salmon in order to secure their eggs. Bulletin 1884 (1884), vol. IV, p. 169. F18–265

——— [Inclosures for salmon in the Netherlands.] Bulletin, 1886 (1887), vol. VI, p. 129–130.

Bower, Ward T.: [Fish culture in Alaska: p. 66–88.] *In* Alaska fisheries and fur industries in 1911, by B. W. Evermann. Report, and special papers, 1911 (1913), 90 p. *Doc. 766 issued Dec. 16, 1912.*

——— [Salmon hatcheries operated in Alaska.] Appendix VII, Report, 1918 (1920), p. 35–38; Appendix IX, Report, 1919 (1920), p. 34–36.

Bower, Ward Taft, and **Henry D. Aller:** [Salmon hatcheries operated in Alaska.] Appendix IX, Report, 1914 (1915), p. 18–27; Appendix III, Report, 1915 (1917), p. 21–28; Appendix II, Report 1916 (1917), p. 29–37; Appendix II, Report, 1917 (1919), p. 23–27.

Bower, Ward Taft, and **H. C. Fassett:** [Salmon hatcheries operated in Alaska in 1913: p. 66–76.] *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II, Report, 1913 (1914).

Brice, John J.: Establishment of stations for the propagation of salmon on the Pacific coast. Report, 1893 (1895), p. 387–392. *Doc. 314 issued 1896.* 12–17363

Chamberlain, Fred M., and **Ward T. Bower**: [Salmon hatcheries operated in Alaska: p. 31–37.] *In* Fishery and fur industries of Alaska in 1912, by B. W. Evermann. Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.*

Cheney, A. Nelson: The Hudson River as a salmon stream. Bulletin, 1897 (1898), vol. XVII, p. 247–251. *Doc. 376 issued Aug. 8, 1898.*

——— Salmon in the Hudson River. Bulletin, 1886 (1887), vol. VI, p. 351–352. F18–610.

Clark, Frank N.: [Propagation of salmon at the United States hatchery, Northville, Michigan.] Report, 1881 (1884), p. 1053–1055; 1882 (1884), p. 820–821; 1883 (1885), p. 981; 1885 (1887), p. 110–112.

Cobb, John Nathan: Salmon fisheries of the Pacific coast. (Salmon culture in Oregon: p. 154.) Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

Collins, John D.: Propagation of salmon in Salmon River, Oswego County, New York. Bulletin, 1885 (1885), vol. V, p. 287–288. F18–442

Day, Francis: On the rearing, growth, and breeding of salmon in freshwater in Great Britain. Bulletin, 1885 (1885), vol. V, p. 307–308. F18–452

Duncan, J. Barker: Salmon and trout hatcheries in Scotland. Bulletin, 1835 (1885), vol. V, p. 451–456. F18–508

Dunn, Horace D.: Do the spawning salmon ascending the Sacramento River all die without returning to the sea? Report, 1878 (1880), p. 815–818. F16–183

Finely, Charles I.: A new salmon hatchery. Bulletin, 1884 (1884), vol. IV, p. 88. F18–236

——— Further report of R. D. Hume's salmon hatchery, Oregon. Bulletin, 1884 (1884), vol. IV, p. 174. F18–266

[**First** breeding of salmon and trout in Canada.] Bulletin, 1884 (1884), vol. IV, p. 362.

Green, Loren W.: [Note from the McCloud River station.] Bulletin, 1885 (1885), vol. V., p. 343.

——— Salmon in the McCloud River during the season of 1886. Bulletin 1886 (1887), vol. VI, p. 334–336.

Green, Seth: The introduction of landlocked salmon into Woodhull Lake, New York, and the subsequent capture of some of them. Bulletin, 1881 (1882), vol. I, p. 421. F18–55.

Haack, Hermann: Raising salmonoids in inclosed waters. Report, 1879 (1882), p. 675–685. F17–18

——— Treatment of young salmonoids and coregoni from the time they leave the egg until they are fully developed and can be placed in open waters. Report, 1879 (1882), p. 687–693. F17–19

Harper, John A.: [Planting landlocked salmon in Pennsylvania.] Bulletin, 1886 (1887), vol. VI, p. 138.

Hodge, E. B.: Culture of landlocked and Penobscot salmon in New Hampshire. Bulletin, 1885 (1885), vol. V, p. 423–424. F18–490

——— [Landlocked salmon eggs from Lake Sunapee.] Bulletin, 1886 (1887), vol. VI, p. 453.

Hubbard, W. B.: Report of the salmon-hatching operations in 1878, at Clackamas hatchery. Report, 1878 (1880), p. 771–772.

[**Landlocked** and Penobscot salmon planted.] Bulletin, 1886 (1887), vol. VI, p. 464.

Lincoln, Benjamin: [Hatching salmon at Dennysville, Maine.] Bulletin, 1884 (1884), vol. IV, p. 314.

Loomis, Watts T.: A landlocked salmon caught in Erie Canal. Bulletin, 1884 (1884), vol. IV, p. 288. F18–312

McDonald, Marshall: [Distribution of salmon eggs by the U. S. Fish commission from January 1, 1886, to June 30, 1887.] Report, 1886 (1889), p. 836–837.

Maitland, Sir James Gibson, bart.: [Report on schoodic salmon sent to Scotland.] Bulletin, 1885 (1885), vol. V, p. 81–82.

Marsh, Millard Caleb, and **John Nathan Cobb**: The fisheries of Alaska in 1910. (Hatcheries: p. 11–12.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Mather, Fred: Report upon the results of salmon planting in the Hudson River. Bulletin, 1887 (1889), vol. VII, p. 409–424. F18–678

O'Malley, Henry: Artificial propagation of the salmons of the Pacific coast. Revised and enlarged. Appendix II, Report, 1919 (1921), 32 p., illus., IX pl. *Doc. 879 issued Jan. 8, 1920.* F20–153

Perrin, M. L.: [Overland journey of eggs.] Report, 1873–75 (1876), p. 449–459.

Pratt, K. B.: Report of salmon-hatching operations on Rogue River, Oregon, 1877–78. Report, 1878 (1880), p. 773–774. F16–180

Rathbun, Richard: [Salmon planting in the Hudson River.] Report, 1888–89 (1892), p. LXVII–LXIX.

——— [Propagation of the sockeye and quinnat salmons.] Report, 1899 (1900), p. 272–274.

Raveret-Wattel, and Bartet: Reproduction of California salmon in the aquarium of Trocadero. Bulletin, 1883 (1883), vol. III, p. 207–208. F12–382

Rich, Willis H.: [Proper time to plant fry of chinook salmon.] Bulletin, 1919–20 (192–), vol. XXXVII, p. 68–71.

Sherman, R. U.: [Salmon fry planted in New York waters.] Bulletin, 1886 (1887), vol. VI, p. 409.

Smiley, Charles W.: The influence of artificial propagation upon production illustrated by the salmon work of the Sacramento River, California. Bulletin, 1884 (1884), vol. IV, p. 201–202. F13–96

Smith, E. L.: Hood River, Oregon, as a place for salmon breeding. Bulletin, 1886 (1887), vol. VI, p. 87–88. F18–543

Smith, Hugh McCormick: [Experiments with salmon ova by Cloudsley Rutter.] Report, 1898 (1899), p. CXL–CXLII.

Some results of the artificial propagation of Maine and California salmon in New England and Canada, recorded in the years 1879 and 1880. (Compiled by the U. S. Fish commissioner from letters from J. H. Thomson, M. A. Green, E. M. Stilwell, H. M. Prentiss, Wm. Wood, and F. Todd.) Bulletin, 1881 (1882), vol. I, p. 270–277.

Summary of reports for 1878, by State fish commissioners respecting the increase of food fishes by artificial propagation (salmon). Report, 1878 (1880), p. 925–928, 935, 937, 938, 942. F16–187

Stone, Livingston: Explorations on the Columbia River from the head of Clarks Fork to the Pacific Ocean, made in the summer of 1883, with reference to the selection of a suitable place for establishing a salmon-breeding station. Report, 1883 (1885), p. 237–258. *Doc. 97 issued Aug. 16, 1886.* F11–241

——— The artificial propagation of salmon on the Pacific coast of the United States, with notes on the natural history of the Quinnat salmon. Bulletin, 1896 (1897), vol. XVI, p. 205–238, pl. 73–87. *Doc. 320 issued Nov. 7, 1896.* F12–113

——— The salmons of the Pacific coast. Report, 1897 (1898), p. 7–26; also *in* Manual of fish-culture, rev. ed., 1900, p. 1–15.

U. S. Bureau of Fisheries: Additional reports relative to the hatching and planting of the Penobscot salmon. By Wm. W. Fletcher, J. H. Slack, Thaddeus Norris, E. Sterling, and H. F. Dousman. Report, 1872 and 1873 (1874), p. 380–384. F15–107

——— Hatching and distribution of California salmon. A. Report on California salmon spawn hatched and distributed, by J. H. Slack. B. Hatching and distribution of California salmon in tributaries of Great Salt Lake, by A. P. Rockwood. Report, 1873–74 and 1874–75 (1876), p. 431–435. F16–22

——— [A. The shipment of salmon ova made to New Zealand.] Report, 1875–76 (1878), p. 959–1003.

U. S. Commissioner of Fisheries: [Propagation of the Atlantic salmon.] Report, 1873–1875 (1876), p. XXX–XXXII; 1875–76 (1878), p. 25–26; 1877 (1879), p. 36–39; 1878 (1880), p. XXVIII–XXIX; 1879 (1882), p. XXXI–XXXIII; 1880 (1883), p. XXXI; 1881 (1884), p. XLVI–XLVII; 1882 (1884), p. LXVIII–XIX; 1883 (1885), p. LXXX–LXXXI; 1884 (1886), p. LV–LVI; 1885 (1887), p. LXXXV–LXXXVII; 1886 (1889), p. XXXIV–XXXV; 1887 (1891), p. XXXIX.

——— [Propagation of the California salmon.] Report, 1873–1875 (1876), p. XXII–XXX; 1875–76 (1878), p. 21–44; 1877 (1879), p. 31–36; 1878 (1880) p. XXV–XXVIII; 1879 (1882), p. XXVII–XXXI; 1880 (1883), p. XXIX–XXX; 1881 (1884), p. XLV–XLVI; 1882 (1884), p. LXX–LXXI; 1883 (1885), p. LXXIX and LXXXI–LXXXII; 1884 (1886), p. LIII–LV; 1885 (1887), p. LXXXIV–LXXXV; 1887 (1891), p. XXXVIII–XXXIX.

Valéry-Mayet, Michel: Hatching salmon eggs at Montpellier, France, and trouble with fungus. Bulletin, 1885 (1885), vol. V, p. 272. F18–434

Walker, C. H.: Location of a salmon hatchery in Oregon. Bulletin, 1885 (1885), vol. V, p. 309–310. F18–455

Ward, F. M.: Young salmon in northern New Jersey. Bulletin, 1886 (1887), vol. VI, p. 345. F18–608

Wilmot, Samuel: Remarks on the scarcity of male and grilse salmon in the rivers of Ontario, Canada. Bulletin, 1881 (1882), vol. I, p. 379–381. F20–148

SAIBLING.

Gilbert, W. L.: Growth of the saibling *(Salmo salvelinus)* in the Old Colony trout ponds at Plymouth, Massachusetts. Bulletin, 1881 (1882), vol. I, p. 427. F18–57

U. S. Commissioner of Fisheries: [Saibling eggs from Germany sent to Plymouth, N. H.] Report, 1881 (1884), p. XLV.

——— [Success with saibling eggs.] Report, 1883 (1885), p. LXXVII.

——— [Successful cultivation.] Report, 1884 (1886), p. LII.

SEA BASS.

Earll, R. E.: Hatching blackfish (*Centropristis atrarius*) and Spanish mackerel. Bulletin, 1884 (1884), vol. IV, p. 415–416. F18–353

U. S. Bureau of Fisheries: [The sea bass.] Report, 1897 (1898), p. 223–224; also *in* Manual of fish-culture, rev. ed., 1900, p. 225–226.

SHAD.

Babcock, William C.: Report of shad operations conducted at Fort Washington, Maryland, in 1883–84. Report, 1883 (1885), p. 1035–1041 incl. tables; 1884 (1886), p. 189–192 incl. tables, pl. F17–35

Baird, Spencer F.: [First efficient steps in artificial propagation.] Report, 1872–73 (1874), p. LII–LIII.

——— [A fish worthy of cultivation.] Report, 1872–73 (1874), p. XLVIII–LIX.

——— [Propagation by the U. S. Commission of fisheries.] Report, 1873–1875 (1876), p. XVIII–XXII; 1875–76 (1878), p. 20–21; 1877 (1879), p. *29–31; 1878 (1880), p. XXXV–XXXIX; 1879 (1882), p. XXXIII–XXXV; 1880 (1883), p. XXXI–XXXIV; 1881 (1884), p. XLVIII–L; 1882 (1884), p. LXXIII–LXXVII; 1883 (1885), p. LXXXIII–LXXXIV; 1884 (1886), p. LVIII–LXI; 1885 (1887), p. LXXXIX–XCV; 1886 (1889), p. XLII.

——— Inducements offered fishermen to furnish shad eggs for the U. S. Commission of fish and fisheries. Bulletin, 1882 (1883), vol. II, p. 389–391, illus. F12–377

Cary, H. H.: [Increase of shad due to propagation.] *Quoted by* Baird. Report, 1884 (1886), p. LXXII.

——— [Shad in Georgia waters.] Bulletin, 1885 (1885), vol. V, p. 100–101.

Clark, Frank Nelson: Report of experiments for determining the smallest amount of water in which young shad and eggs can be kept. Report, 1881 (1884), p. 783–786. F16–340

——— Notes on experiments in penning shad and taking eggs at Battery station, Havre de Grace, Md., in 1883. Report, 1883 (1885), p. 1045–1050. F17–37

Daniell, William C.: Letters referring to experiments of W. C. Daniell, M. D., in introducing shad into the Alabama River. Report, 1871 and 1872 (1873), p. 386–390. F15–108

Day, Francis: On the rearing, growth, and breeding of salmon in fresh water in Great Britain. Bulletin, 1885 (1885), vol. V, p. 307. F18–452

——— Experiments with salmon in Scotland. Bulletin, 1886 (1887), vol. VI, p. 56. F18–532

Eckardt, R.: The experiments in propagating maifische (*Alosa vulgaris*) in 1876 (1877). Report, 1877 (1879), p. 853–866. F16–122

Fenton, Henry J.: [Shad hatching in Connecticut.] Bulletin, 1884 (1884), vol. IV, p. 310–311.

——— [Shad hatching in Connecticut in 1884.] Bulletin, 1884 (1884), vol. IV, p. 319–320.

——— [Shad hatching and distribution in Connecticut in 1886.] Bulletin, 1886 (1887), vol. VI, p. 405.

Ferguson, T. B.: Extracts from a report of investigations of the shad fisheries and rivers south of Charleston, S. C., with a view to establishing stations for artificial propagation. Bulletin, 1884 (1884), vol. IV, p. 244–248. F18–299

Griffith, William: Result of planting shad in the Ohio River. Bulletin, 1882 (1883), vol. II, p. 12. F18–62

Hamlen, William: Reconnaissance of Florida rivers with a view to shad hatching. Bulletin, 1884 (1884), vol. IV, p. 206–208. F13–98

——— Report of shad-hatching operations at Battery station, Havre de Grace, Md. Bulletin, 1885 (1885), vol. V, p. 401–410. F18–484

——— Report on the shad work of the steamer *Halcyon* during the season of 1887. Bulletin, 1887 (1889), vol. VII, p. 111. F18–596

Harding, Charles William: Inquiries concerning the propagation of American smelt and shad, and notes on the fisheries of the Wash in England. Bulletin, 1881 (1882), vol. I, p. 428–429. F18–58

Huske, C. J.: Shad work in South Carolina. Bulletin, 1883 (1883), vol. III, p. 446. F18–178

——— Report on the shad work in South Carolina in 1883. Transportation of shad eggs on trays. Bulletin, 1884 (1884), vol. IV, p. 161–164. F13–91

McDonald, Marshall: [Propagation of shad.] Report, 1882 (1884), p. 881–883.

——— Distribution of shad through Central station by the United States Fish commission in 1882. Report, 1882 (1884), p. 899–902, tables. F16–314

——— Shad eggs sent to Cold Springs Harbor, New York, to be hatched. Bulletin, 1884 (1884), vol. IV, p. 198. F18–280

——— Report of the shad propagation on the Potomac River during the season of 1885 and 1886. Bulletin, 1885 (1885), vol. V, p. 369–385; 1886 (1887), vol. VI, p. 436–438.

——— Report of shad propagation on the Potomac River during the season of 1885 and 1886. Report, 1885 (1887), p. 369–385; 1886 (1889), p. 815–817.

——— Report of shad distribution for the season of 1886. Report, 1886 (1889), p. 801–806.

——— Report of shad distribution for 1886 and 1887. Bulletin, 1886 (1887), p. 302, 427–432; 1887 (1889), p. 105–109 incl. tables. F18–658

——— [Shad hatching in 1887.] Report, 1887 (1891), p. XLII–XLIV.

Milner, James W.: Report on the propagation of the shad (*Alosa sapidissima*) and its introduction into new waters by the U. S. Fish commission in 1873. Report, 1872 and 1873 (1874), p. 419–451. F15–111

——— The propagation and distribution of shad. Report, 1875–76 (1878), p. 901–909; 1877 (1879), p. 847–852; 1878 (1880), p. 611–628. F16–74, F16–121, F16–171

Page, William F.: Effects of sunlight upon shad eggs. Bulletin, 1885 (1885), vol. V, p. 308. F18–453

Rice, Henry J.: Experiments upon retarding the development of eggs of the shad, made in 1879, at the United States shad-hatching station at Havre de Grace, Md. Report, 1881 (1884), p. 787–794, illus. F16–341

Ryder, John Adam: On the retardation of the development of the ova of the shad (*Alosa sapidissima*), with observations on the egg fungus and bacteria. Bulletin, 1881 (1882), vol. I, p. 177–190. F12–319

——— Additional observations on the retardation of the development of the ova of the shad. Bulletin, 1881 (1882), vol. I, p. 422–424. F12–240

——— On the retardation of the development of the ova in the shad (*Alosa sapidissima*), with observations on the egg fungus and bacteria. Report, 1881 (1884), p. 795–811. F16–342

Smiley, Charles Wesley: Statistics of the shad-hatching operations conducted by the United States Fish commission in 1881 and 1882. Report, 1881 (1884), p. 1107–1119, incl. tables; 1882 (1884), p. 903–913, tables. F16–346, F16–329

——— Result of planting shad in the Muskingum River. Bulletin, 1882 (1883), vol. II, p. 32. F18–73

——— Planting and catching of shad in Coosa River, Alabama. Bulletin, 1883 (1883), vol. III, p. 200. F18–125

Smith, Everett: Results of planting shad in the Kennebec River. Bulletin, 1887 (1889), vol. VII, p. 16 F18–637

Smith, Hugh McCormick: [History of the introduction of shad in the Pacific States.] Bulletin, 1895 (1896), vol. XV, p. 404–427, pl. 76.

Stevenson, Charles H.: [Effects of dams on artificial reproduction of shad.] Bulletin, 1897 (1898), vol. XVII, p. 265–271.

Stone, Livingston: [Overland journey with live shad from New York to California.] Report, 1873–1875 (1876), p. 377–429.

U. S. Bureau of Fisheries: The propagation and distribution of the shad. A. Operations in the distribution of shad in 1874, by J. W. Milner. B. Report on shad-hatching in New Jersey, by G. A. Anderson. C. Voyage to Bremerhaven, Germany, with shad, by F. Mather. D. Living shad on their way to the Weser, tr. by H. Jacobson. E. Shad hatching and distribution of operations of 1875. Report, 1873–74 and 1874–75 (1876), p. 323–349. F16–18

——— On the transportation of shad for long distances. A. Experiments with a view to transporting shad in sea water, by James W. Milner. B. Experiments with a view to transporting shad a few months old, by Charles D. Griswold. C. Apparatus for hatching shad ova while en route to new waters, by Fred Mather. Report, 1873–74 and 1874–75 (1876), p. 363–376, illus. F16–20

——— Report on shad-hatching operations. Report, 1872 and 1873 (1874), p. 403–418. F15–110

——— Report on the propagation and distribution of shad (*Alosa sapidissima*) in the spring of 1880. Report, 1880 (1883), p. 653–672, tables. F16–302

——— Report of operations at Havre de Grace, Maryland. Report, 1883–1886 (1884–1887); 1883, p. 1043–1044; 1884, p. 196–208; 1886, p. 761–763, 807–814. F17–36

——— Report of shad-hatching operations at Battery station, Havre de Grace, Md., season of 1885 and 1887. Bulletin, 1885 (1885), vol. V, p. 401–410; 1886 (1887), vol. VI, p. 361–368; 1887 (1891), vol. VII, p. 95–100, incl. tables. F18–613

U. S. Bureau of Fisheries: Report of the operations of the U. S. Fish commission steamer *Fish Hawk* in shad-hatching during the seasons of 1885, 1886, 1887. Bulletin, 1885 (1885), vol. V, p. 395–400; 1886 (1886), vol. VI, p. 289–293; 1887 (1889), vol. VII, p. 83–89. F18–594

——— Report on the shad work of the steamer *Lookout.* Report, 1884 (1886), p. 123–127; 1885 (1887), p. 97–101; 1886 (1889), p. 825–827. F17–123

——— Report of shad-hatching operations by the steamer *Lookout* during the seasons of 1885, 1886, 1887. Bulletin, 1885 (1885), vol. V, p. 386–394; 1886 (1886), vol. VI, p. 295–297; 1887 (1887), vol. VII, p. 95–100. F18–596

U. S. Commissioner of Fisheries: [Investigations of spawning grounds of shad.] Report, 1897 (1898), p. XXXVIII–XXXIX.

Wallem, Frederik Meltzer: [Hatching young shad for the sake of the fisheries.] Report, 1878 (1880), p. 104–106.

Wood, William Maxwell: Report of the operations of the U. S. steamer *Lookout* from March 31, 1881, to November 20, 1882. Report, 1882 (1884), p. 35–37. F16–322

——— Report of a trip by the steamer *Fish Hawk* to the St. Mary's and St. John's rivers to hatch shad. Bulletin, 1884 (1884), vol. IV, p. 241–242. F18–297

——— Report of operations at the navy-yard shad-hatching station in Washington, D. C., during the season of 1882. Report, 1882 (1884), p. 891–897, pl. F16–321

Worth, Stephen G.: Shad hatching and carp culture. Bulletin, 1882 (1883), vol. II, p. 26–27. F18–71

——— A poor season for shad hatching in North Carolina. Bulletin, 1882 (1883), vol. II, p. 54. F18–74

——— Observations on the spawning habits of the shad. Bulletin, 1891 (1893), vol. XI, p. 201–206. *Doc. 209 issued Mar. 11, 1893.* F12–127

——— The shad. Report, 1897 (1898), p. 133–158; also *in* Manual of fish-culture, rev. ed., 1900, p. 121–145.

——— Possible expansion of shad-hatchery work. Bulletin, 1908 (1910), vol. XXVIII, p. 789–793. *Doc. 678 issued April, 1910.* 10–35420

SHEEPSHEAD.

Rathbun, Richard: [Successful hatching of sheepshead eggs on *Fish Hawk.*] Report, 1888–89 (1892), p. LIX.

U. S. Bureau of Fisheries: [The sheepshead.] Report, 1897 (1898), p. 224–225; also *in* Manual of fish-culture, rev. ed., 1900, p. 226–227.

SMELTS.

Harding, Charles William: Inquiries concerning the propagation of American smelt and shad, and notes on the fisheries of the Wash in England. Bulletin, 1881 (1882), vol. I, p. 428–429. F18–58

Mather, Fred: [Smelt successfully hatched at Cold Spring Harbor.] Report, 1885 (1887), p. 113.

U. S. Bureau of Fisheries: [The smelt.] Report, 1897 (1898), p. 188; also *in* Manual of fish-culture, rev. ed., 1900, p. 190.

U. S. Commissioner of Fisheries: [Success in hatching smelts at Cold Springs Harbor.] Report, 1885 (1887), p. XCVI. Report, 1886 (1889), p. XXX.

STURGEON.

Dean, Bashford: Recent experiments in sturgeon hatching on the Delaware River. Bulletin, 1893 (1894), vol. XIII, p. 335–339, illus. *Doc. 261 issued June 26, 1894.* F12–183

Leach, Glen C., and Nicolas A. Borodin: Artificial propagation of sturgeon. Review of sturgeon culture in the United States, by Glen C. Leach, and Artificial propagation of sturgeon in Russia, by Nicolas A. Borodin. Appendix III, Report, 1919 (1921), 7 p. *Doc. 880 issued Feb. 19, 1920.* F20–I

Rathbun, R.: [Sturgeon eggs successfully hatched.] Report, 1893 (1895), p. 48–49.

Ravenel, W. de C.: [Sturgeon culture at Cape Vincent.] Report, 1901 (1902), p. 38–42.

Ryder, J. A.: [Sturgeon culture.] Bulletin, 1888 (1890), vol. VIII, p. 268–276.

U. S. Bureau of Fisheries: The artificial propagation of sturgeon in Schleswig-Holstein, Germany. (Reports translated from the German.) Bulletin, 1889 (1891), vol. IX, p. 81–90. *Doc. 151 issued May 29, 1891.* F12–139

——— [The sturgeons.] Report, 1897 (1898), p. 189–191; also *in* Manual of fish-culture, rev. ed., 1900, p. 191–193.

U. S. Commissioner of Fisheries: [Experiments with sturgeon spawn.] Report, 1887 (1891), p. XLV.

——— [Sturgeon work in Minnesota.] Report, 1912 (1914), p. 51.

SUCKERS.

Fraley, W. R.: [Carp mullets cultivated in North Carolina.] Bulletin, 1886 (1887), vol. VI, p. 403–404.

Gardner, A. P.: Experiments in the pond culture of trout, suckers, and catfish. Bulletin, 1883 (1883), vol. III, p. 417–420 F18–157

SQUETEAGUE.

Hughes, Smith E.: Live ponds for fish in New Jersey (weakfish). Bulletin, 1881 (1882), vol. I, p. 349–351. F20–126

Rathbun, Richard: [Eggs of spotted weakfish successfully hatched on *Fish Hawk*.] Report, 1888–89 (1892), p. LIX.

——— [First attempt of artificial propagation.] Report, 1889–1891 (1893), p. 160.

U. S. Bureau of Fisheries: [The squeteague.] Report, 1897 (1898), p. 224; also *in* Manual of fish-culture, rev. ed., 1900, p. 226.

TAUTOG.

U. S. Bureau of Fisheries: [The tautog.] Report, 1897 (1898), p. 219–220; also *in* Manual of fish-culture, rev. ed., 1900, p. 221–222.

TROUT.

Barbour, C. H.: [Success with trout and salmon.] Bulletin, 1886 (1887), vol. VI, p. 144.

Clark, Frank N.: [Trout work of the U. S. hatchery, Northville, Mich.] Report, 1881 (1884), p. 1049–1056; 1882 (1884), p. 818–822; 1883 (1885), p. 979–981; 1884 (1886), p. 156–161; 1885 (1887), p. 124–126; 1886 (1889), p. 732–736.

——— Spawning of California mountain trout, reared in confinement, from eggs brought from McCloud River. Bulletin, 1883 (1883), vol. III, p. 256. F18–130

——— The brook trout. Report, 1897 (1898), p. 91–101; also *in* Manual of fish-culture, rev. ed., 1900, p. 80–90.

——— The lake trout. Report, 1897 (1898), p. 103–117; also *in* Manual of fish-culture, rev. ed., 1900, p. 91–105.

Clarke, H. R.: [A rainbow trout reared from eggs brought from California.] Bulletin, 1884 (1884), vol. IV, p. 360.

——— Propagation of trout by the Southside Club. Bulletin, 1885 (1885), vol. V, p. 436. F18–500

Crawford, S. M.: [Trout breeding.] Bulletin, 1884 (1884), vol. IV, p. 364–365.

Delano, J. S., and **Frantz, Emanuel H.**: [Growth of California trout.] Bulletin, 1885 (1885), vol. V, p. 100.

Delawder, G. W.: [Cultivation of California trout and landlocked salmon.] Bulletin, 1885 (1885), vol. V, p. 108.

Dowell, Benjamin Franklin: Efforts in trout culture. Bulletin, 1884 (1884), vol. IV, p. 64. F18–224

——— Cultivating trout in Oregon. Bulletin, 1884 (1884), vol. IV, p. 217. F18–286

Duncan, J. Barker: Salmon and trout hatcheries in Scotland. Bulletin, 1885 (1885), vol. V, p. 451–456. F18–508

Evermann, Barton Warren: The golden trout of the southern high Sierras. (Contains also: Temperature conditions in the Kern River region, by O. P. Jenkins: p. 50–51.) Bulletin, 1905 (1906), vol. XXV, 51 p., XVII pl. (partly col.), fold. map. *Doc. 595 issued May 19, 1906.* F11–66

Follett, Richard E.: [Trout culture in Connecticut.] Bulletin, 1885 (1885), vol. V, p. 351.

Gardner, A. P.: Experiments in the pond culture of trout, suckers, and catfish. Bulletin, 1883 (1883), vol. III, p. 417–420. F18–157

Gilbert, W. L.: The past, present, and future of trout culture. Bulletin, 1893 (1894), vol. XIII, p. 47–48. *Doc. 242 issued June 9, 1894.* F12–183

Green, Loren W.: Condition of the United States trout ponds. Bulletin, 1885 (1885), vol. V, p. 309. F18–454

Green, Seth: Rearing of California mountain trout (*Salmo irideus*). Bulletin, 1881 (1882), vol. I, p. 23. F18–11

Growth of rainbow trout. Bulletin, 1884 (1884), vol. IV, p. 360.

Haack, Herman: Treatment of young salmonoids and coregoni from the time they leave the egg till they are fully developed and can be placed in open water. Report, 1879 (1882), p. 687–693. F17–19

Holberton, Wakeman: The successful stocking of (Ohio) streams with trout. Bulletin, 1883 (1883), vol. III, p. 192. F18–123

Huske, C. J.: Report on California trout distribution in South Carolina. Bulletin, 1884 (1884), vol. IV, p. 164–165. F18–259

Jaffe, S.: [Notes on the rearing of yearling trout at Sandfort.] Bulletin, 1895 (1896), vol. XV, p. 317–319.

Kennedy, B. E. B.: [California trout in Nebraska.] Bulletin, 1885 (1885), vol. V, p. 104.

Koss, R. A.: Trout and trout culture. Bulletin, 1883 (1883), vol. III, p. 473–476. F12–389

Kunnel: On the conditions under which trout exist on the German waters. Bulletin, 1884 (1884), vol. IV, p. 393–395. F18–348

Land, Gordon: [Hatching and feeding of Rocky Mountain trout.] Bulletin, 1886 (1887), vol. VI, p. 314–315.

Leach, Glen C.: Culture of rainbow trout and brook trout in ponds. 19 p., illus. *Economic Circular 41 issued Feb. 20, 1919.* F19–3

McDonald, Marshall: California trout planted in Roanoke River in July, 1883, retaken in June, 1884. Bulletin, 1884 (1884), vol. IV, p. 286. F18–311

——— California trout for the Ozark mountain region. Bulletin, 1886 (1887), vol. VI, p. 447–448. F18–630

——— [Breed California trout at Wytheville.] Report, 1885 (1887), p. LXXXV.

——— Report of operations at the trout-breeding station at Wytheville, Va., from its occupation in January, 1882, to the close of 1884. Report, 1885 (1887), p. 103–108. F20–163

——— [Distribution of trout eggs by the U. S. Fish commission from January 1, 1886, to June 30, 1889.] Report, 1886 (1889), p. 833–842.

Mather, Fred: Eggs received from foreign countries at Cold Springs Harbor, N. Y., and retained or forwarded during the seasons of 1883–84 and 1884–85. Report, 1884 (1886), p. 143–146. F20–164

——— [Propagation of trout at Cold Springs Harbor, Long Island.] Report, 1884 (1886), p. 130–134, pl.; 1885 (1887), p. 109–112; 1886 (1889), p. 721.

Maynard, H. J.: Rainbow trout in southwestern Missouri. Bulletin, 1887 (1889), vol. VII, p. 55–56. F18–647

Metcalf, Martin: Success in propagating California mountain trout from eggs brought to Michigan by the U. S. Fish commission. Bulletin, 1883 (1883), vol. III, p. 471–472. F18–197

Neelley, J. N.: [Propagating trout in Kentucky.] Bulletin, 1885 (1885), vol. V, p. 108.

New York Sun: [Increase of California trout.] Bulletin, 1886 (1887), vol. VI, p. 133.

Page, W. F.: [Trout-rearing at Neosho, Mo.] Bulletin, 1894 (1895), vol. XIV, p. 71–72.

——— Feeding and rearing fishes, particularly trout, under domestication. (Bibliography: p. 312–314.) Bulletin, 1894 (1895), vol. XIV, p. 289–314. *Doc. 294 issued May 22, 1895.* 12–17377

Paige, Charles L.: A method of cultivating rainbow trout and other salmonoids. Bulletin, 1908 (1910), vol. XXVIII, p. 781–787, diagrs. *Doc. 677 issued April, 1910.* 10–35421

Peebles, M. T.: [Note on trout culture.] Bulletin 1885 (1885), vol. V, p. 467.

Pierce, John: [Lake trout in Colorado.] Bulletin, 1886 (1887), vol. VI, p. 134.

Pierre, H. J.: [Hatching rainbow trout.] Bulletin, 1885 (1885), vol. V, p. 347.

Redmond, Roland: On rainbow trout reared from eggs brought from California. Bulletin, 1883 (1883), vol. III, p. 230. F18–127

Seagle, George A.: [California trout propagation at Wytheville, Va.] Bulletin, 1885 (1885), vol. V, p. 350.

——— [California trout in Holston River and in tributaries of New River.] Bulletin, 1886 (1887), vol. VI, p. 140.

——— The artificial propagation of the rainbow trout. Bulletin, 1896 (1897), vol. XVI, p. 239–256, illus., pl. 88–94. *Doc. 319 issued Nov. 17, 1896.* F12–111

——— The rainbow trout. Report, 1897 (1898), p. 71–89; also *in* Manual of fish-culture, rev. ed., 1900, p. 61–79.

Smiley, Charles Wesley: Loch Leven trout introduced in the United States. Bulletin, 1887 (1889), vol. VII, p. 28–32. F18–644

Smith, Silas B.: Efforts to raise trout. Bulletin, 1885 (1885), vol. V, p. 435–436. F18–499

Starkey, George A.: [Trout for sale.] Bulletin, 1885 (1885), vol. V, p. 108.

Stone, Livingston: Report of operations at the United States trout ponds, McCloud River, California. Report, 1879 (1882), p. 715–720; 1880 (1883), p. 615–621; 1881 (1884), p. 1079–1083; 1882 (1884), p. 851–855; 1884 (1886), p. 171–176; 1885 (1887), p. 131–140; 1886 (1889) p. 737–745.

——— Segregation of the sexes of trout. Bulletin, 1885 (1885), vol. V, p. 448. F18–505

[**Trout culture in England.**] Bulletin, 1885 (1885), vol. V, p. 338.

Tuttle, J. S.: [Rainbow trout, eels, and hatching of carp.] Bulletin, 1886 (1887), vol. VI, p. 133–134.

U. S. Bureau of Fisheries: [Minor trouts.] Report, 1897 (1898), p. 179–180; also *in* Manual of fish-culture, rev. ed., 1900, p. 181–182.

Wilson, Charles A.: Raising brook trout in mineral water. Bulletin, 1882 (1883), vol. II, p. 392. F18–112

WHITEFISH.

Bower, Seymour: Instructions for taking whitefish eggs. Bulletin, 1884 (1884), vol. IV, p. 113–114. F18–239

Buck, H. H.: Report upon hatching one million whitefish eggs from the Great Lakes, at Orland, Me., and upon planting the young in Eagle Lake, Mount Desert. Bulletin, 1883 (1883), vol. III, p. 454–455. F18–182

Clark, Frank Nelson: Report of operations connected with the propagation of whitefish (*Coregonus albus*) at the Northville station, Northville, Michigan, for the season of 1880–81. Report, 1880 (1883), p. 553–596. F16–276

——— [Propagating whitefish at the United States hatchery, Northville, Mich.] Report, 1881 (1884), p. 1038–1040; 1882 (1884), p. 813–838; 1883 (1885), p. 975–979; 1884 (1886), p. 151–156; 1885 (1887), p. 123–124.

——— On the rearing of the whitefish in spring-water, and its relation to their subsequent distribution. Bulletin, 1881 (1882), vol. I, p. 301–306.

——— On the propriety of depositing [whitefish] minnows off the harbor of Cleveland, Ohio. Bulletin, 1883 (1883), vol. III, p. 349–353. F12–398

——— [Success of whitefish propagation.] Bulletin, 1885 (1885), vol. V, p. 99–100.

——— Results of planting young whitefish in Lake Erie. What the fishermen think of whitefish propagation. Bulletin, 1885 (1885), vol. V, p. 113–121. F18–382

——— Natural as compared with artificial hatching of whitefish. Bulletin, 1885 (1885), vol. V, p. 321–323. F18–465

——— Whitefish distributed from Northville and Alpena stations. Bulletin, 1887 (1889), vol. VII, p. 65–66. F18–652

——— History and methods of whitefish culture. Bulletin, 1893 (1894), vol. XIII, p. 213–220. *Doc. 257 issued June 26, 1894.* F12–183

——— A plan for promoting the whitefish production of the Great Lakes. Bulletin, 1908 (1910), vol. XXVIII, p. 635–642. *Doc. 673 issued Apr. 14, 1910.* 10–35439

Curtis, J. E.: [Propagation of whitefish.] Bulletin, 1884 (1884), vol. IV, p. 335–336. F18–326

Downing, Seth W.: A plan for promoting the whitefish production of the Great Lakes. Bulletin, 1908 (1910), vol. XXVIII, p. 627–633. *Doc. 672 issued Apr. 14, 1910.* 10–35439

Greenfield, Alfred: Report upon the receipt and hatching of American whitefish ova and planting of the fry in Australia. Bulletin, 1884 (1884), vol. IV, p. 190–191. F18–279

Haack, Hermann: Treatment of young salmonoids and coregoni from the time they leave the egg till they are fully developed and can be placed in open waters. Report, 1879 (1882), p. 687–693. F17–19

McDonald, Marshall: [Distribution of whitefish by the U. S. Fish commission from January 1, 1886, to June 30, 1887.] Report, 1886 (1889), p. 835.

Mason, Frank Holcomb: Proposed exportation of whitefish eggs to Switzerland. Bulletin, 1883 (1883), vol. III, p. 272. F18–131

Mather, Fred: [Propagation of whitefish at Cold Springs Harbor, Long Island.] Report, 1884 (1886), p. 134; 1885 (1887), p. 109, 1886 (1889), p. 721.

Metcalf, Martin: Planting whitefish and other Salmonidæ in inland lakes. Bulletin, 1886 (1887), vol. VI, p. 422–423. F18–622

Milner, James W.: [History of whitefish culture in the Great Lakes.] Report, 1872 and 1873 (1874), p. 25–34.

Page, W. F.: Shrinkage of whitefish eggs during transportation on trays. Bulletin, 1886 (1887), vol. VI, p. 360. F18–612

——— [Record of whitefish eggs received and hatched at Druid Hill hatching house, Baltimore, Md.] Bulletin, 1884 (1884), vol. IV, p. 316.

Reighard, Paul Roby: A plan for promoting the whitefish production of the Great Lakes. [With discussion by Edward E. Prince, C. H. Wilson, Kelly Evans, Barton W. Evermann, Tarlton H. Bean, Charles E. Fryer, John W. Titcomb, W. E. Meehan, Seymour Bower, W. T. Thompson, Frank N. Clark, Samuel F. Fullerton, and Dwight Lydall.] Bulletin, 1908 (1910), vol. XXVIII, p. 643–684, diagrs. *Doc. 674 issued Apr. 14, 1910.* 10–35439

Smith, Hugh McCormick: [Introduction of whitefish in California.] Bulletin, 1895 (1896), vol. XV, p. 428–430, pl. 77.

Sterling, E.: On the impropriety of depositing whitefish minnows off the harbor of Cleveland, Ohio. Fishing for saugers. Bulletin, 1883 (1883), vol. III, p. 302–303. F18–141

Stranahan, J. J.: The methods, limitations, and results of whitefish culture in Lake Erie. Bulletin, 1897 (1898), vol. XVII, p. 315–318. *Doc. 388 issued Aug. 8, 1898.* F–12110

——— The whitefish. Report, 1897 (1898), p. 119–131; also *in* Manual of fish-culture, rev. ed., 1900, p. 109–120.

Tomlin, W. David: [Results of planting whitefish fry in Lake Superior.] Bulletin, 1886 (1887), vol. VI, p. 411.

U. S. Commissioner of Fisheries: [Propagation of whitefish.] Report, 1872–73 (1874), p. XXV–XLVI; 1873–1875 (1876), p. XXXII; 1875–76 (1878), p. 26–27; 1877 (1879), p. 39; 1878 (1880), p. XXXV; 1880 (1883), p. XXVII–XXIX; 1881 (1884), p. XLIV; 1882 (1884), p. LXIV–LXVIII; 1883 (1885), p. LXXVI–LXXVII; 1884 (1886), p. XLIX–LI; 1885 (1887), p. LXXVIII–LXXX; 1886 (1889), p. XXX.

Worth, S. G.: [Propagation of the cisco at Put in Bay.] Report, 1893 (1895), p. 101.

TURBOT.

Anthony, Raoul Louis Ferdinand: The cultivation of the turbot. Bulletin, 1908 (1910), vol. XXVIII, p. 859–870, pl. CII–CIII, illus. *Doc. 686 issued April, 1910.* 10–35563

METHODS.

Behr, Friedrich von: Treatment of fish eggs at sea. Bulletin, 1881 (1882), vol. I, p. 346–347. F20–112

Borne, Max von dem: Dry transmission of fish eggs. Bulletin, 1881 (1882), vol. I, p. 345.

Hessel, Rudolph: Method of treating adhesive eggs of certain fishes, especially of the Cyprinidæ in artificial propagation. Report, 1872–73 (1874), p. 566–570, pl. XVII–XVIII. F15–117

Mason, Frank H.: [Description of method employed by Lugrin at Gremaz, France, for producing food for young fish.] Bulletin, 1887 (1889), vol. VII, p. 203–205.

Nussbaum: A simple test to learn if fish ova are impregnated. (Tr. by John A. Ryder.) Bulletin, 1882 (1883), vol. II, p. 347–348. F12–371

Page, William F.: The most recent methods of hatching fish eggs. Bulletin, 1888 (1890), vol. VIII, p. 207–218, illus., pl. XXX–XXXVI. *Doc. 139 issued Mar. 13, 1890.* F11–321

Reisenbichler, G. F.: The thick or thin fertilization of eggs. Report, 1879 (1882), p. 633–635. F17–11

Stenzel, Alexander: On the so-called "dry" method of impregnation of spawn. Report, 1872 and 1873 (1874), p. 571–575. F15–118

Wallich, Claudius: A method of recording the egg development for use of fish culturists. Report, 1900 (1901), p. 185–194, pls. F11–71

AERATION.

Atkins, C. G.: [Aeration in hatching salmon.] Report, 1878 (1880), p. 950–951, illus.

——— [Aeration in salmon culture.] Report, 1897 (1898), p. 38–39; also *in* Manual of fish-culture, rev. ed., 1900, p. 26–27.

Bean, Tarleton Hoffmann: [Oxygenizing water.] Report, 1894 (1896), p. 32–33.

Bettoni, Eugenio, and Decio Vinciguerra: [Necessity of water aeration.] Report, 1886 (1889), p. 545–547.

Harron, L. G.: [Linden plugs for areation.] Report, 1893 (1895), p. 95.

McDonald, Marshall: Experiments in the transportation of the German carp in a limited supply of water. Bulletin, 1881 (1882), vol. I, p. 215–218. F12–321

Ryder, John Adam: [Experiments by Marshall McDonald on methods of aeration.] Report, 1888–89 (1892), p. 521.

Seal, William P.: The keeping of Salmonidæ for purposes of exhibition. Bulletin, 1887 (1889), vol. VII, p. 283–285, illus. F18–676

Sharp, J.: [Transporting bass.] Bulletin, 1897 (1898), vol. XVII, p. 363–368.

Vincent, Eugene: Devices for use in fish hatcheries and aquaria. Bulletin, 1908 (1910), vol. XXVIII, p. 1025–1035. *Doc. 705 issued April, 1910.* 10–35556

APPARATUS AND APPLIANCES.

Atkins, Charles G.: Cheap fixtures for the hatching of salmon. Report, 1878 (1880), 25 p., illus. *Doc. 21 issued May 29, 1879.* F11–209

Bayer, Hector von: A method of measuring fish eggs. Bulletin, 1908 (1910), vol. XXVIII, p. 1009–1014, diagrs. *Doc. 703 issued April, 1910.* 10–35426

Bettoni, Eugenio: [Hatching apparatus.] Report, 1886 (1889), p. 548–562.

Clark, F. N.: The self-picker. Bulletin, 1881 (1882), vol. I, p. 62–65. F18-22

——— [Clark hatching-box.] Report, 1897 (1898), p. 96–97; also *in* Manual of fish-culture, rev. ed., 1900, p. 84–85.

Dannevig, Gunder Mathisen: Apparatus and methods employed at the marine fish hatchery at Flödevig, Norway. Bulletin, 1908 (1910), vol. XXVIII, p. 799–809, illus., pl. CI, diagrs. *Doc. 680 issued April, 1910.* 10–35442

Ewart, Cosser: [A new hatching box.] Bulletin, 1884 (1884), vol. IV, p. 316.

Fuller, Alfred E.: New and improved devices for fish culturists. Bulletin, 1908 (1910), vol. XXVIII, p. 991–1000, pl. CIV-CVI. *Doc. 700 issued April, 1910.* 10–35566

Giles, W. S.: [Tanks for transferring fish from the Mississippi River to Kansas.] Bulletin, 1884 (1884), vol. IV, p. 312.

Huske, C. J.: [McDonald, automatic jar.] Bulletin, 1884 (1884), vol. IV, p. 164.

Kincaid, Walter S.: New methods of transporting eggs and fish. Bulletin, 1908 (1910), vol. XXVIII, p. 1037–1039. *Doc. 706 issued April, 1910.* 10–35425

Kite, J. Alban: Report upon apparatus needed and facilities for hatching Spanish mackerel. Report, 1883 (1885), p. 1095–1100, illus. F17–40

Klotz, J. P. J.: [Hatching apparatus.] Report, 1880 (1883), p. 499–504, illus.

LaValete St. George, Adolf Johann Hubert: A new fish-hatching apparatus. Bulletin, 1883 (1883), vol. III, p. 209–212, illus. F18–126

——— A new fish-hatching apparatus. Bulletin, 1883 (1883), vol. III, p. 448. F18–181

McDonald, Marshall: [Apparatus for hatching buoyant fish eggs.] Report, 1881 (1884), p. 1127–1129, illus.

——— History of the experiments leading to the development of the automatic fish-hatching jar. Bulletin, 1883 (1883), vol. III, p. 183–192, illus. F12–379

——— [A moving hatchery.] Bulletin, 1885 (1885), vol. V, p. 106.

Milner, James W.: [Apparatus used in shad hatching in 1878.] Report, 1878 (1880), p. 615–617.

Page, William F.: [Description of the McDonald universal hatching jar.] Bulletin, 1888 (1890), vol. VIII, p. 209–218, illus., pl. XXX–XXXVI.

Robinson, Robert K.: A device for counting young fish. Bulletin, 1908 (1910), vol. XXVIII, p. 1001–1004, diagrs. *Doc. 701 issued April, 1910.* 10–35422

Ryder, John Adam: [Description of McDonald apparatus, and use in prolonging period of incubation of shad ova.] Bulletin, 1881 (1882), vol. I, p. 182–183.

Simms, George E.: An improvement in hatching and rearing boxes; with notes on the continuous feeding of the fry of Salmonidæ. Bulletin, 1908 (1910), vol. XXVIII, p. 1015–1023. *Doc. 704 issued April, 1910.* 10–35445

Stone, Livingston: [Williamson troughs.] Report, 1897 (1898), p. 18–19; also *in* Manual of fish-culture, rev. ed., 1900, p. 12–13.

U. S. Bureau of Fisheries: Descriptions of improved apparatus in fish hatching. Report, 1872–73 (1874), p. 578–587. F15–120

——— On the transportation of shad for long distances. A. Experiments with a view to transporting shad in sea water, by James W. Milner. B. Experiments with a view to transporting shad a few months old, by Charles D. Griswold. C. Apparatus for hatching shad ova while en route to new waters. Report, 1873–74 and 1874–75 (1876), p. 363–376, illus. F16–20

——— [Chester boxes.] Report, 1897 (1898), p. 204–205, pl. 57; also *in* Manual of fish-culture, rev. ed., 1900, p. 206–207, pl. 58.

——— [McDonald tidal boxes.] Report, 1897 (1898), p. 202–204, illus., pl. 56; also *in* Manual of fish-culture, rev. ed., 1900, p. 204–206, illus., pl. 57.

Vincent, Eugene: Devices for use in fish hatcheries and aquaria. Bulletin, 1908 (1910), vol. XXVIII, p. 1025–1035. *Doc. 705 issued April. 1910.* 10–35556

Wood, William Maxwell: [Apparatus for hatching Spanish mackerel.] Report, 1883 (1885), p. 1091, illus.

Worth, S. G.: [McDonald automatic hatching jar.] Report, 1897 (1898), p. 150–153, illus., pl. 41; also *in* Manual of fish-culture, rev. ed., 1900, p. 138–141, illus., pl. 46.

MISCELLANEOUS.

Baird, S. F.: [History of fish-culture.] Report, 1872–73 (1873), p. XXXI–XXXIV.

Behr, Friedrich von: [Address made at meeting of German fishery association at Berlin, Mar. 16, 1877, by Mr. Behr, of Schmoldow, president of the association, member of the German parliament.] Report, 1875 and 1876 (1878), p. 1014–1024.

Benecke, B.: Utilizing water by fish-culture. Report, 1883 (1885), p. 1101–1131. *Doc. 103 issued Aug. 16, 1886.* F11–247

Borne, Max von dem: On pond fisheries. Report, 1879 (1882), p. 649–650. F16–13

——— Success of fish-culture. Bulletin, 1884 (1884), vol. IV, p. 115–123. F13–88

Clark, Frank N.: Disadvantage of planting small fish. Bulletin, 1886 (1887), vol. VI, p. 421–422. F18–621

Ducastel, M.: The transformation of salt marshes into fish ponds. Report, 1880 (1883), p. 517–531, illus. F16–279

Hiester, Charles E.: Fish-culture for profit. Bulletin, 1881 (1882), vol. I, p.382-383. F20–125

Johnson, Robert S., and Mortimer Freeman Stapleton: Fish ponds on farms. Appendix II, Report, 1915 (1917), 28 p., XIX pl. *Doc. 826 issued Dec. 15, 1915.* F16–79

——— Fish ponds on farms. 32 p., illus. *Doc. 826, revised edition, issued 1917.* F17–259

K., Baron von: Fish-culture as a means of improving the race of fish. Bulletin, 1885 (1885), vol. V., p. 289–291. F18–443

Klotz, J. P. J.: On the artificial propagation of fish. Report, 1880 (1883) p. 491–516, illus. F16–289

Lyman, Theodore: Fish-culture in salt or brackish water. Report, 1872 and 1873 (1874), p. 575–578, pl. XIX. F15–119

Marsh, Millard Caleb: Notes on the dissolved content of water in its effect upon fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 891–906. *Doc. 688 issued April, 1910.* 10–35560

——— The treatment of fish-cultural waters for the removal of algæ. Bulletin, 1908 (1910), vol. XXVIII, p. 871–890, illus. *Doc. 687 issued April, 1910.* 10–35567

Mead, Albert Davis: A new principle of aquiculture and transportation of live fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 759–780, pl. XC–C, diagrs. *Doc. 676 issued April, 1910.* 10–35565

Möbius, Karl August: Can we do anything to decrease, preserve, or increase the number of our useful marine animals? Bulletin, 1883 (1883), vol. III, p. 393–400. F12–421

Moore, Emmeline: The Potamogetons in relation to pond culture. Bulletin, 1913 (1915), vol. XXXIII, p. 251-291, pl. XXII–XXXIX. *Doc. 815 issued July 28, 1915.* F15–84

——— Some plants of importance in pond-fish culture. (Bibilography: p. 19–20.) Appendix IV, Report, 1919 (1921), 20 p., fold. chart. *Doc. 881 issued Mar. 24, 1920.* F20–108

Mulertt, Hugo: [Price list of Hugo Mulertt, 507 Race Street, Cincinnati, Ohio.] Bulletin, 1885 (1885), vol. V, p. 109–110.

Nicklas, Carl: Pond culture. Report, 1884 (1886), p. 467–655, illus. *Doc. 111 issued Dec. 1, 1886.* F11–293

Page, William F.: [Size of fish eggs and number contained in a quart.] Bulletin, 1886 (1887), vol. VI, p. 405–406.

Peat-bogs as fish-pounds. Bulletin, 1881 (1882), vol. I, p. 58–59. F18–19

Popular Science Monthly: [Spawning of fish in confinement.] Bulletin, 1886 (1887), vol. VI, p. 308–309.

Raveret-Wattel, C.: Report on the condition of pisciculture in foreign countries from documents collected at the International fishery exposition at Berlin, 1880. Report, 1880 (1883), p. 477–489. F16–295

Reighardt, E.: The injurious influence on pisciculture of the retting water of flax and hemp. Report, 1880 (1883), p. 545–550. F16–296

Smiley, C. W.: A geographical catalogue of persons who have stated that they are interested in fish-culture. Bulletin, 1882 (1883), vol. II, p. 393–449. F18–113

——— What fish-culture has first to accomplish. Bulletin, 1884 (1884), vol. IV, p. 65–68. F13–82

Some results of the artificial propagation of Maine and California salmon in New England and Canada recorded in the years 1879 and 1880. Compiled by the United States Fish commissioner from letters received. Bulletin, 1881 (1882), vol. I, p. 270–277. F20–142

Stange, J.: Fish becoming blue and rigid during transportation. Bulletin, 1886 (1887), vol. VI, p. 64. F18–535

Titcomb, John W.: Aquatic plants in pond culture. Report and special papers, 1907 (1909), 31 p., II pls., illus. *Doc. 643 issued Feb. 8, 1909.* 9–35225

U. S. Bureau of Fisheries: Observations upon fishes and fish-culture. Bulletin, 1890 (1892), vol. X, p. 49–61. *Doc. 188 issued June 20, 1892.* F12–135

Verdict against artificial fish-culture, and an answer thereto. Bulletin, 1883 (1883), vol. III, p. 382–387. F20–166

Wagner, C.: What does a fish cost? Report, 1878 (1880), p. 605–607. F16–170

Wengen, von der: A review of the failures and successes of artificial fish-culture. Report, 1884 (1886), p. 437–461. F17–135

Wilson, Charles Branch: Dragonflies and damselflies in relation to pondfish culture, with a list of those found near Fairport, Iowa. (Bibliography: p. 260–264.) Bulletin, 1917–18 (1921), vol. XXXVI, p. 179–264, illus., pl. LXVII–LXIX. *Doc. 882 issued Aug. 4, 1920.* F20–160

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Baird, Spencer Fullerton: [Decrease of food-fishes.] Report, 1871–72 (1873), p. XVIII–XXXIII; 1872–73 (1874), p. I–XVI; 1873–1875 (1876), p. VII–XV; 1875–76 (1878), p. 4–8.

——— [Diminution of fishes.] Report, 1886 (1889), p. 59–72.

Chadwick, B. P.: The destruction of young fish by unsuitable fishing implements. Bulletin, 1881 (1882), vol. I, p. 339–340. F20–115

Chapman, Pearson, sr.: Habits of the shad and herring, as they appear in the Potomac River to one who has watched them for fifty years. Bulletin, 1884 (1884), vol. IV, p. 61–64. F13–81

Church, Daniel T.: Why the size of mesh in menhaden seines should not be restricted. Bulletin, 1883 (1883), vol. III, p. 463. F18–188

Goode, George Brown.: [Inquiry into causes of fishery deterioration.] Report, 1884 (1886), p. 1145–1148.

Green, Loren W.: [Decrease in salmon on the Pacific coast.] Bulletin, 1886 (1887), vol. VI, p. 286–288.

Hardy, L. H.: [Destruction of fish by Dutch nets.] Bulletin, 1884 (1884), vol. IV, p. 317.

McDonald, Marshall: [Causes concurring in producing a decrease in the river fisheries of the Atlantic States.] Report, 1882 (1884), p. 43–44.

——— [Diminution of fish.] Report, 1887 (1891), p. V.

Nickerson, Seth: Destruction of small fish in weirs. Bulletin, 1884 (1884), vol. IV, p. 184. F18–274

Rathbun, Richard: [Decrease of food-fishes.] Report, 1888–89 (1893), p. XLIII–XLIV; 1894 (1896), p. 100–114.

Spangler, A. M.: The decrease of food-fishes in American waters and some of the causes. Bulletin, 1893 (1894), vol. XIII, p. 21–35. *Doc. 239 issued June 6, 1894.* F12–183

Wallem, Fredrik Meltzer: [Diminution of fishes.] Report, 1879 (1882), p. 102–103.

CALIFORNIA.

Tanner, Zera Luther: [Diminution of fish in California.] Report, 1894 (1896), p. 217–218.

FLORIDA.

Brice, John J.: [Diminution of fish in Florida.] Report, 1896 (1898), p. 268–269, 341–342.

MAINE.

A **petition** to the Fish commission of the United States, signed by the fishermen of Block Island, June 12, 1877. Report, 1878 (1880), p. 35–39. F16–152

Tibbetts, N. V.: Scarcity of cod and haddock on the coast of Maine. Bulletin, 1886 (1887), vol. VI. p. 75–76. F18–537

RHODE ISLAND.

Rhode Island, General assembly, Senate Committee on fisheries: Pleadings before the Senate Committee on fisheries, of the Rhode Island legislature, at its January session of 1872. Argument of J. Talbot Pitman in favor of a law prohibiting the use of traps and pounds in Rhode Island. Abstract of an address by Captain Nathaniel E. Atwood, in opposition to legislation. Before the Senate committee of Rhode Island legislature, January session, 1872. Report, 1871–72 (1873), p. 196–227. F16–61

UTAH.

Siler, Andrew L.: Depletion of fish in Panguitch and Bear Lakes, Utah. Bulletin, 1884 (1884), vol. IV, p. 51. F18–214

WASHINGTON.

Rathbun, Richard: [Periodicity in abundance of fish in Washington.] Report, 1899 (1900), p. 274–277.

GREAT LAKES.

Laflin & Co.: Need of a national law to regulate the size of mesh of both pound and gill nets on the Great Lakes. Bulletin, 1884 (1884), vol. IV, p. 223–224. F18–292

Milner, James W.: [Diminution of food-fishes of the Great Lakes.] Report, 1871 and 1872 (1873), p. 1–72.

Sheley, G. A.: Destruction of fish caused by nets of small mesh in Lake Michigan. Bulletin, 1884 (1884), vol. IV, p. 353. F18–331

Smith, Hugh McCormick: [Causes of the decreased abundance of fish in the Great Lakes.] Report, 1887 (1891), p. 152, 215–216, 243–244.

Sterling, E.: Notes on the Great Lakes fisheries, depletion of black bass, etc. Bulletin, 1884 (1884), vol. IV, p. 218–219. F18–287

GULF OF ST. LAWRENCE.

Collins, Joseph William: On the scarcity of mackerel in the Gulf of St. Lawrence. Bulletin, 1884 (1884), vol. IV, p. 427–430 and 435–438. F13–119 and F18–359

ONTARIO.

Wilmot, Samuel: Introduction of California salmon into Ontario, with remarks on the disappearance of Maine salmon from that province. Bulletin, 1881 (1882), vol. I, p. 347–349. F20–146

EUROPE.

BELGIUM.

Selys-Longchamps, Edmond, *i. e.* **Michel Edmond Selys de:** Repopulation of the water-courses in Belgium. Report, 1881 (1884), p. 815–824. F16–343

FRANCE.

Gifford, George: The disappearance of sardines from the Vendean coast, and its causes. Bulletin, 1882 (1883), vol. II, p. 4. F18–63

GERMANY.

Behr, Friedrich von: [Decrease of fish in Germany.] Report, 1875–76 (1878), p. 1016–1024.

Benecke, Berthold: [Decrease of the fisheries in Germany.] Report, 1884 (1886), p. 1186.

Möbius, Karl August: Can we do anything to decrease, preserve, or increase the number of our useful marine animals? Bulletin, 1883 (1883), vol. III, p. 393–400. F12–421

GREAT BRITAIN.

Bertram, James G.: [On the possibility of exhausting the sea fisheries of Europe.] Report, 1871–72 (1873), p. 141–144.

Commissioner appointed to inquire into the sea fisheries: [Extracts from the Report of the Commissioners appointed to inquire into the sea fisheries of the United Kingdom; presented to both houses of Parliament by command of Her Majesty. London, 1861.] Report, 1871–72 (1873), p. 145–148. F16–58

Royal commission on trawling: [On the diminution of the ocean fisheries.] Bulletin, 1885 (1885), vol. V, p. 96–99.

Scotland. Fishery Board: [Diminution of fish in Scotland.] Report, 1882 (1884), p. 230–236.

NORWAY.

Ljungman, Axel Vilhelm: [Causes for the diminution of the salt-water fisheries of Bohuslan.] Report, 1878 (1880), p. 206–220.

RUSSIA.

Soudakevicz, Theodore: [The decrease of food fishes in Russia.] Report, 1872–73 (1874), p. 493–495.

BALTIC SEA.

Widegren, Hjalmar: [Diminution of the fisheries of the Baltic.] Report, 1878 (1880), p. 125–126.

INDIA.

Day, Francis: [Decrease of fisheries in India.] Report, 1883 (1885), p. 385–388

SPECIES.

BLUEFISH.

Baird, Spencer Fullerton: [Diminution of the scup and bluefish in New England.] Report, 1871–72, (1873) p. 229, 235–252.

CATFISH.

Smith, Hugh McCormick: [Diminution of catfish.] Report, 1897 (1898), p. xcviii–xcix.

GRAYLING.

Fitzhugh, D. H.: [Decrease of grayling in Au Sable River.] Bulletin, 1884 (1884), vol. IV, p. 470.

HERRING.

Jensen, Olaf Scheveland: Report on the practical and scientific investigations of the spring herring fisheries, during the year 1880, submitted to the Department of the Interior. Report, 1880 (1883), p. 127-161. F16-288

Ljungman, Axel Vilhelm: Contribution toward solving the question of the secular periodicity of the great herring fisheries. Report, 1879 (1882), p. 497-503. F17-6

Moore, Henry Frank: [Decrease of the herring in the waters of Passamaquoddy Bay and vicinity.] Report, 1896 (1898), p. 417-430.

MACKEREL.

Moore, J. Percy: [Diminution of mackerel.] Report, 1898 (1899), p. 3-4.

MENHADEN.

Goode, George Brown: [Diminution of menhaden.] Report, 1877 (1879), p. 101-112.

POMPANO.

Wilcox, William A.: [Diminution of pompano.] Report, 1896 (1898), p. 252.

SALMON.

Redding, Joseph D.: Causes of the decrease of salmon in the Sacramento River. Bulletin, 1887 (1889), vol. VII, p. 57-58. F18-649

U. S. Commissioner of Fisheries: [Diminution of salmon.] Report, 1898 (1899), p. XX-XXIV.

Watson, W. C.: [The disappearance of the salmon and its causes.] Report, 1873-74 and 1874-75 (1876), p. 534-538.

SHAD.

Milner, James W.: [Diminution of shad.] Report, 1873-74 and 1874-75 (1876), p. 354-362.

Slack, James H.: [The causes of decrease of shad in the Delaware.] Report, 1872-73 (1874), p. 457-458.

Stevenson, Charles H.: The restricted inland range of shad due to artificial obstructions, and its effect on natural reproduction. Bulletin 1897 (1898), vol. XVII, p. 265-271. *Doc. 376 issued Aug. 8, 1898.* F12-110

——— [Diminution of shad of the Atlantic coast of the United States.] Report, 1898 (1899), p. 103-127.

Yarrow, Harry Crécy: [Great decrease of shad in Georgia and North Carolina.] Report, 1872-73 (1874), p. 396-397.

TILEFISH.

Baird, Spencer Fullerton: [Diminution of tilefish.] Report, 1882 (1884), p. LII.

FISHERMEN.

UNITED STATES.

GENERAL.

Collins, J. W.: [Extracts from records and reminiscences of fishermen.] Report, 1881 (1884), p. 307-443.

Freeman: [Cape Cod fishermen.] *Quoted by* Goode *in* The fisheries and fishery industries of the United States. 1887. Sec. IV, p. 146-149.

Goode, G. Brown, and Joseph William Collins: The fishermen of the United States. *In* The fisheries and fishery industries of the United States. 1887. Sec. IV, 145 p.; Appendix, 19 p.

ALASKA.

Bower, Ward Taft and H. C. Fassett: [Alien fishermen in Alaska.] Appendix II, Report, 1913 (1914), p. 39–40.

CALIFORNIA.

San Francisco Chronicle: Italian fishermen in San Francisco. Bulletin, 1885 (1885), vol. V, p. 281–283. F18–439

FLORIDA.

Collins, Joseph William: [The fishermen engaged in the fisheries of western Florida.] Report, 1885 (1887), p. 282–283.

Wilcox, William A.: [Fishermen of Indian River, Florida.] Report, 1896 (1898), p. 257–258.

TEXAS.

Stevenson, Charles Hugh: [Fishermen engaged in the coast fisheries of Texas.] Report, 1889–1891 (1893), p. 375.

GREAT LAKES.

Smith, Hugh McCormick: [The fishermen of the Great Lakes in 1885.] Report, 1887, 1891 p. 35, 43–44, 57, 72, 93, 107, 171, 174–176, 178, 185, 214, 247, 290–292, 298, 306, 308, 310.

PACIFIC COAST.

Collins, Joseph William: [Fishermen of the Pacific coast of the United States.] Report, 1888–89 (1893), p. 46, 51, 59, 64, 75, 100–103, 127–128, 144, 163–164, 172, 180–181, 184, 186, 188, 194, 197, 204, 238, 241, 245.

Wilcox, William A.: [Pacific coast fishermen.] Report, 1893 (1895), p. 139–304.

EUROPE.

ICELAND.

Annaniassen, A.: [Fishermen of Iceland.] Report, 1884 (1886), p. 312–313.

Garde, Aug.: [Pay of Iceland fishermen.] Report, 1884 (1886), p. 303–307.

Thorsteinson, A.: [Food of fishermen in Iceland.] Report, 1884 (1886), p. 320–321.

SWEDEN.

Lundberg, Rudolph: [The fishermen of Sweden.] Report, 1884 (1886), p. 373.

INDIA.

Day, Francis: [Fishermen of India—Castes and condition.] Report, 1883 (1885), p. 385, 408–413.

HAWAIIAN ISLANDS.

Cobb, J. N.: [Fishermen of the Hawaiian Islands.] Report, 1901 (1902), p. 387–393.

SPECIAL FISHERIES.

HADDOCK.

Goode, George Brown, and Collins, J. W.: [Types of men engaged in haddock fishery.] Bulletin, 1881 (1882), vol. I, p. 227.

HALIBUT.

Scudder, Newton Pratt: [Fishermen of the halibut fishery—Davis's Strait.] Report, 1880 (1883), p. 220–226.

MACKEREL.

Goode, George Brown: [Fishermen engaged in the mackerel fishery of the United States.] Report, 1881 (1884), p. 139, 173–174.

MENHADEN.

Greer, Rob Leon: [Fishermen of the menhaden fishery of the Atlantic coast.] Appendix III, Report, 1914 (1915), p. 26.

SALMON.

Cobb, John Nathan: [Fishermen and other employees engaged in the salmon fisheries of the Pacific coast.] Report and special papers, 1910 (1911), p. 35–36.

STURGEON.

Cobb, John Nathan: [Fishermen engaged in the sturgeon fishery of the Delaware River.] Report, 1899 (1900), p. 373.

MORTALITY.

Benecke, Berthold: [Dangers to fishermen.] Report, 1884 (1886), p. 1190–1191.

Bland, John: [A suggestion for avoiding the danger incident to the transfer of fish from the smacks to the collecting steamers.] Bulletin, 1884 (1884), vol. IV, p. 359–360.

Collins, Joseph William: Loss of life and property in the Gloucester fisheries. Bulletin, 1884 (1884), vol. IV, p. 180–181. F18–272

Forbes, Robert Bennet: Loss of life and property in the fisheries. Bulletin, 1884 (1884), vol. IV, p. 181–182. F18–273

Wilcox, William A.: A man killed by a swordfish. Bulletin, 1886 (1887), vol. VI, p. 417–418. F18–621

STATISTICS.

UNITED STATES.

GENERAL.

Alexander, A. B.: [Report on statistics of the fisheries of the United States and Alaska from 1901 to 1904.] Report, 1904 (1905), p. 146–149.

Baird, Spencer Fullerton: [Statistics of the food-fishes.] Report, 1877 (1879), p. 12–17; 1879 (1882), p. XV–XXII; 1880 (1883), p. XXIV–XXVII; 1881 (1884), p. XXV–XLII; 1883 (1885), p. LVII–LXXI; 1885 (1887), p. LVII–LXXII; 1886 (1889), p. 20–23.

Bowers, George M.: [Statistical inquiries concerning fisheries of the United States.] Report, 1901 (1902), p. 11–13.

Smiley, Charles Wesley: Methods and results of an effort to collect statistics of the fish trade throughout the United States. Bulletin, 1882 (1883), vol. II, p. 247–253. F12–361

——— Statistics of the imports and exports of fish, fish-oil, whalebone, etc., for ten years ending June 30, 1882. Bulletin, 1883 (1883), vol. III, p. 273–278 incl. tables. F18–134

——— A statistical review of the production and distribution to public waters of young fish by the United States Fish Commission, from its organization to the close of 1880. Report, 1881 (1884), p. 825–915. F16–345

——— Statistics of the United States imports and exports of fish, fish oil, whalebone, the tonnage of fishing vessels, etc., for the year ending June 30, 1883, and for the year ending June 30, 1884. Report, 1883 (1885), p. 301–315; 1884 (1886), p. 241–263. F17–26

Smith, Hugh McCormick: Statistics of the fisheries of the United States. Bulletin, 1893 (1894), vol. XIII, p. 389–417. *Doc. 276 issued July 5, 1894.* F12–183

——— Statistics of the fisheries of the interior waters of the United States. Report, 1896 (1898), p. 489–574. *Doc. 361 issued Mar. 23, 1898.* F11–184

U. S. Bureau of Fisheries: Statistical review of the coast fisheries of the United States. Report, 1888–89 (1892), p. 271–378. *Doc. 177 issued Sept. 25, 1891.* F15–56

ALABAMA.

Smith, Hugh McCormick: [Statistics of the fisheries of Alabama in 1894.] Report, 1895 (1896), p. 106. Report, 1896 (1898), p. 489–501, 531–533.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Alabama in 1887 and 1888.] Report, 1888–89 (1892), p. 365.

——— [Statistics of the fisheries of Alabama in 1897.] Report, 1899 (1900), p. 128–135.

——— [Statistics of the fisheries of Alabama in 1899.] Report, 1901 (1902), p. 693.

——— [Statistics of the fisheries of Alabama for 1902.] Report, 1903 (1905), p. 444–451.

ALASKA.

Cobb, John Nathan: The commercial fisheries of Alaska in 1905. (Statistics: p. 38–43.) Report and special papers, 1905 (1907), 46 p. *Doc. 603 issued Oct. 16, 1906.* 6–35319

Marsh, Millard Caleb: The fisheries of Alaska in 1908. (Statistics: p. 17.) Report and special papers, 1908 (1910), p. 17–19. *Doc. 645 issued Apr. 17, 1909.* 7–35263

ARKANSAS.

Smith, Hugh McCormick: [Statistics of the fisheries of Arkansas for 1894.] Report, 1896 (1898), p. 543–547.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Arkansas for 1899.] Report, 1901 (1902), p. 661–670, 701–707.

CALIFORNIA.

Smith, Hugh McCormick: [Statistics of the fisheries of California.] Report, 1896 (1898), p. 572.

Townsend, Charles Haskins: [Statistics of the fisheries of southern California in 1898.] Report, 1898 (1899), p. CLXII–CLXIV.

U. S. Bureau of Fisheries: [Statistics of the fisheries of California in 1888.] Report, 1888–89 (1892), p. 374–376.

CONNECTICUT.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Connecticut in 1888.] Report, 1888–89 (1892), p. 316–322.

——— [Statistics of the fisheries of Connecticut in 1898.] Report, 1900 (1901), p. 379–386.

——— [Statistics of Connecticut in 1902.] Report, 1904 (1905), p. 316–325.

——— [Statistics of the fisheries of Connecticut in 1905.] Report, 1906 (1908), p. 83–93.

DELAWARE.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Delaware]. Report, 1888–89 (1892), p. 336–339.

——— [Statistics of the fisheries of Delaware.] Report, 1900 (1901), p. 263–267.

——— [Statistics of the fisheries of Delaware in 1901.] Report, 1902 (1904), p. 484–488.

——— [Statistics of the fisheries of Delaware in 1904.] Report, 1905 (1907), p. 62–66.

FLORIDA.

Alexander, A. B.: [Statistics of the fisheries of the interior waters of Florida in 1902.] Report, 1904 (1905), p. 133–134.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Florida.] Report, 1888–89 (1892), p. 360–364.

——— [Statistics of the fisheries of western Florida.] Report, 1899 (1900), p. 112–128.

——— [Statistics of the fisheries of eastern Florida.] Report, 1899 (1900), p. 218–227.

——— [Statistics of the fisheries of western Florida in 1902.] Report, 1903 (1905), p. 419–443.

——— [Statistics of the fisheries of eastern Florida in 1902.] Report, 1903 (1905), p. 397–410.

Wilcox, William A.: [Statistics of the fisheries of the Indian River, Florida, in 1895.] Report, 1896 (1898), p. 258–262.

GEORGIA.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Georgia.] Report, 1888–89 (1892), p. 350–360.

——— [Statistics of the fisheries of Georgia in 1897.] Report, 1899 (1900), p. 210–218.

——— [Statistics of the fisheries of Georgia in 1902.] Report, 1903 (1905), p. 386–397.

IDAHO.

Smith, Hugh McCormick: [Statistics of the fisheries of Idaho in 1894.] Report, 1896 (1898), p. 573–574.

ILLINOIS.

Smith, Hugh McCormick: [Statistics of the fisheries of Illinois in 1894.] Report, 1896 (1898), p. 519–523.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Illinois in 1899.] Report, 1901. (1902), p. 676–684.

INDIANA.

Smith, Hugh McCormick: [Statistics of the fisheries of Indiana in 1894.] Report, 1896 (1898), p. 512–517.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Indiana in 1899.] Report, 1901 (1902), p. 673–676.

IOWA.

Smith, Hugh McCormick: [Statistics of the fisheries of Iowa in 1894.] Report, 1896 (1898), p. 552–555.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Iowa in 1899.] Report 1901 (1902), p. 714–722.

——— [Statistics of the fisheries of Lake Pepin and Lake Keokuk during 1917.] Report, 1918 (1920), p. 77–80.

KANSAS.

Smith, Hugh McCormick: [Statistics of the fisheries of Kansas in 1894.] Report, 1896 (1898), p. 570–571.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Kansas in 1899.] Report, 1901 (1902), p. 738–740.

KENTUCKY.

Smith, Hugh McCormick: [Statistics of the fisheries of Kentucky in 1894.] Report, 1896 (1898), p. 524–527.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Kentucky in 1899.] Report, 1901 (1902), p. 685–688.

LOUISIANA.

Smith, Hugh McCormick: [Statistics of the fisheries of Louisiana in 1894.] Report, 1896 (1898), p. 538–542.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Louisiana.] Report, 1888–89 (1892), p. 368–370.

——— [Statistics of the fisheries of Louisiana in 1897.] Report, 1899 (1900), p. 145–159.

——— [Statistics of the fisheries of Louisiana in 1899.] Report, 1901 (1902), p. 697–701.

——— [Statistics of the fisheries of Louisiana in 1902.] Report, 1903 (1905), p. 465–473.

MAINE.

Earll, R. Edward: Statistics of the fisheries of Maine. (Census bulletin no. 278.) 1881, 47 p. *Doc. 45 issued May 2, 1882.* F12–239

U. S. Bureau of Fisheries: [Statistics of the fisheries of Maine in 1888.] Report, 1888–89 (1892), p. 288–297.

——— [Statistics of the fisheries of Maine in 1898.] Report, 1900 (1901), p. 322–340.

——— [Statistics of the fisheries of Maine in 1902.] Report, 1904 (1905), p. 253–277.

MARYLAND.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Maryland.] Report, 1888–89 (1892), p. 340–344.

——— [Statistics of the fisheries of Maryland in 1897.] Report, 1900 (1901), p. 268–287.

——— [Statistics of the fisheries of Maryland in 1901.] Report, 1902 (1904), p. 489–516.

MASSACHUSETTS.

Cape Anne Breeze: [Statistics of the fisheries of Gloucester for 1884.] Bulletin, 1885 (1885), vol. V, p. 343.

Smith, Hugh McCormick: [The fisheries of Boston and Gloucester in 1891.] Report, 1892, (1894), p. CLX–CLXIV.

——— [Inquiries relative to the fisheries of Boston and Gloucester, 1893 to 1896.] Report, 1894 (1896), p. 162–166; 1895 (1896), p. 113–120; 1896 (1898), p. 130–136; 1897 (1898), p. CXXXII–CXXXVI.

Townsend, Charles Haskins: [The fisheries of Gloucester and Boston, 1897 to 1901.] [Report, 1898 (1899), p. CXLVIII–CLII; 1899 (1900), p. CLIII–CLVIII; 1900 (1901), p. 167–173; 1901 (1902), p. 142–149; 1902 (1904), p. 144–150.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Massachusetts in 1887 and 1888.] Report, 1888–89 (1892), p. 300–311.

——— [Statistics of the fisheries of Massachusetts in 1898.] Report, 1900 (1901), p. 343–363.

——— [Statistics of the Fisheries of Massachusetts in 1902.] Report, 1904 (1905), p. 281–305.

——— [Statistics of the New England vessel fisheries at Boston and Gloucester.] Report, 1906 (1908), p. 16; 1907 (1909), p. 14; 1908 (1910), p. 13–16; 1909 (1911), p. 17–22; 1910 (1911), p. 23–27; 1911 (1913), p. 38–49; 1912 (1914), p. 24–37; 1913 (1914), p. 49–59; 1914 (1915), p. 6–18; 1915 (1917), p. 43–60; 1916 (1917), p. 76–95; 1917 (1919), p. 12–32; 1918 (1920), p. 38–61.

MICHIGAN.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Michigan in 1899.] Report, 1901 (1902), p. 654–655.

MINNESOTA.

Smith, Hugh McCormick: [Statistics of the fisheries of Minnesota in 1894.] Report, 1896 (1898), p. 560–564.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Minnesota in 1899.] Report, 1901 (1902), p. 725–730.

MISSISSIPPI.

Smith, Hugh McCormick: [Statistics of the fisheries of Mississippi in 1894.] Report, 1896 (1898), p. 534–537.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Mississippi.] Report, 1888–89 (1892), p. 366–368.

——— [Statistics of the fisheries of Mississippi in 1897.] Report, 1899 (1900), p. 135–144.

——— [Statistics of the fisheries of Mississippi in 1899.] Report, 1901 (1902), p. 694–697.

——— [Statistics of the fisheries of Mississippi in 1902.] Report, 1903 (1905), p. 451–464.

MISSOURI.

Smith, Hugh McCormick: [Statistics of the fisheries of Missouri in 1894.] Report, 1896 (1898), p. 548–551.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Missouri in 1899.] Report, 1901 (1902), p. 707–713.

NEBRASKA.

Smith, Hugh McCormick: [Statistics of the fisheries of Nebraska in 1894.] Report, 1896 (1898), p. 568–569.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Nebraska in 1899.] Report, 1901 (1902), p. 734–737.

NEVADA.

Smith, Hugh McCormick: [Statistics of the fisheries of Nevada in 1894.] Report, 1896 (1898), p. 572.

Townsend, Charles Haskins: [Statistics of commercial fishing in Nevada in 1900.] Report, 1901 (1902), p. 162.

NEW HAMPSHIRE.

U. S. Bureau of Fisheries: [Statistics of the fisheries of New Hampshire in 1887 and 1888.] Report, 1888–89 (1892), p. 298–300.

——— [Statistics of the fisheries of New Hampshire in 1898.] Report, 1900 (1901), p. 341–342.

——— [Statistics of the fisheries of New Hampshire in 1902.] Report, 1904 (1905), p. 277–281.

NEW JERSEY.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of New Jersey.] Report, 1888–89 (1892), p. 328–332.

——— [Statistics of the fisheries of New Jersey in 1897.] Report, 1900 (1901), p. 222–254.

——— [Statistics of the fisheries of New Jersey in 1901.] Report, 1902 (1904), p. 458–477.

——— [Statistics of the fisheries of New Jersey in 1904.] Report, 1905 (1907), p. 29–55.

——— [Statistics of coastal fisheries of New York and New Jersey, by counties, exclusive of shellfish, 1915.] Report, 1916 (1917), p. 72–75.

——— [Statistics of the coastal fisheries of New York and New Jersey in 1917.] Report, 1918 (1920), p. 66–70.

NEW YORK.

Smith, Hugh McCormick: [Statistics of the fisheries of New York in 1894 and 1895.] Report, 1896 (1898), p. 502–507.

U. S. Bureau of Fisheries: [Statistics of the fisheries of New York in 1887 and 1888.] Report, 1888–89 (1892), p. 324–328.

——— [Statistics of the fisheries of New York in 1897.] Report, 1900 (1901), p. 203–222.

——— [Statistics of the fisheries of New York in 1899.] Report, 1901 (1902), p. 657.

——— [Statistics of the fisheries of New York in 1901.] Report, 1902 (1904), p. 442–457.

——— [Statistics of the fisheries of the interior lakes and streams of New York in 1903.] Report, 1904 (1905), p. 136.

——— Statistics of costal fisheries of New York and New Jersey, by counties, exclusive of shellfish, 1915. Report, 1916 (1917), p. 72–75.

——— [Statistics of the coastal fisheries of New York and New Jersey in 1917.] Report, 1918 (1920), p. 66–70.

——— [Statistics of the wholesale fresh-fish trade of New York City in 1917.] Report, 1918 (1920), p. 73–76.

NORTH CAROLINA.

U. S. Bureau of Fisheries: [Statistical review of the fisheries of North Carolina.] Report, 1888–89 (1892), p. 352–356.

——— [Statistics of the fisheries of North Carolina in 1897.] Report, 1899 (1900), p. 177–203.

——— [Statistics of the fisheries of North Carolina in 1902.] Report, 1903 (1905), p. 350–377.

OHIO.

Smith, Hugh McCormick: [Statistics of the fisheries of Ohio in 1894.] Report, 1896 (1898), p. 509–511.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Ohio in 1899.] Report, 1901 (1902), p. 672.

OREGON.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Oregon in 1888.] Report, 1888–89 (1892), p. 376–377.

Wilcox, William A.: [Statistics of the fisheries of Oregon in 1889–1892.] Report, 1893 (1895), p. 213–239.

——— [The fisheries of Oregon in 1895.] Report, 1896 (1898), p. 615–631.

——— [Statistics of the fisheries of Oregon in 1899.] Report, 1901 (1902), p. 535–549.

PENNSYLVANIA.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Pennsylvania.] Report, 1888–89 (1892), p. 333–335.

——— [Statistics of the fisheries of Pennsylvania in 1897.] Report 1900 (1901), p. 255–262.

——— [Statistics of the fisheries of Pennsylvania in 1901.] Report, 1902 (1904), p. 477–483.

——— [Statistics of the fisheries of Pennsylvania in 1904.] Report, 1905 (1907) p. 55–62.

RHODE ISLAND.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Rhode Island in 1887 and 1888.] Report, 1888–89 (1892), p. 312–316.

——— [Statistics of the fisheries of Rhode Island in 1898.] Report, 1900 (1901), p. 364–379.

——— [Statistics of the fisheries of Rhode Island in 1902.] Report, 1904 (1905), p. 305–316.

SOUTH CAROLINA.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of South Carolina.] Report, 1888–89 (1892), p. 356–358.

——— [The fisheries of South Carolina in 1897.] Report, 1899 (1900), p. 204–209.

——— [Statistics of the fisheries of South Carolina in 1902.] Report, 1903 (1905), p. 378–386.

SOUTH DAKOTA.

Smith, Hugh McCormick: [Statistics of the fisheries of South Dakota in 1894.] Report, 1896 (1898), p. 564–567.

U. S. Bureau of Fisheries: [Statistics of the fisheries of South Dakota in 1899.] Report, 1901 (1902), p. 730–733.

TENNESSEE.

Smith, Hugh McCormick: [Statistics of the fisheries of Tennessee in 1894.] Report, 1896 (1898), p. 528–530.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Tennessee in 1899.] Report, 1901 (1902), p. 689–692.

TEXAS.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Texas.] Report, 1888–89 (1892), p. 371–373.

——— [Statistics of the fisheries of Texas in 1897.] Report, 1896 (1898), p. 160–169.

——— [Statistics of the fisheries of Texas in 1902.] Report, 1903 (1905), p. 474–481.

UTAH.

Smith, Hugh McCormick: [Statistics of the fisheries of Utah in 1895.] Report, 1896 (1898), p. 571.

Townsend, Charles Haskins: [Statistics of the fisheries of Utah in 1900.] Report, 1902 (1904), p. 151–152.

VERMONT.

Smith, Hugh McCormick: [Statistics of the fisheries of Vermont in 1894 and 1895.] Report, 1896 (1898), p. 501–502.

U. S. Bureau of Fisheries: [Statistics of the fisheries of the interior lakes and streams of Vermont in 1902.] Report, 1904 (1905), p. 137.

VIRGINIA.

U. S. Bureau of Fisheries: [Statistical review of the coast fisheries of Virginia.] Report, 1888–89 (1892), p. 345–351.

——— [Statistics of the fisheries of Virginia in 1897.] Report, 1900 (1901), p. 288–310.

——— [Statistics of the fisheries of Virginia in 1901.] Report, 1902 (1904), p. 517–540.

WASHINGTON.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Washington in 1888.] Report, 1888–89 (1892), p. 377–378.

——— [Statistics of the vessel fisheries of Seattle in 1916.] Report, 1917 (1919), p. 40–43.

——— [Statistics of fishery products landed at Seattle.] Report, 1913 (1914), p. 62–64; 1918 (1920), p. 61–65.

Wilcox, William A.: [Statistics of the fisheries of Washington in 1889, 1890, 1891, and 1892.] Report, 1893 (1895), p. 255–297.

——— [Notes on the fisheries of Washington in 1895.] Report, 1896 (1898), p. 591–613.

——— [Statistics of the fisheries of Washington.] Report, 1901 (1902), p. 512–534.

WEST VIRGINIA.

Smith, Hugh McCormick: [Statistics of the fisheries of West Virginia in 1894.] Report, 1896 (1898), p. 508.

U. S. Bureau of Fisheries: [Statistics of the fisheries of West Virginia in 1899.] Report, 1901 (1902), p. 671.

WISCONSIN.

Smith, Hugh McCormick: [Statistics of the fisheries of Wisconsin in 1894.] Report, 1896 (1900), p. 556–559.

U. S. Bureau of Fisheries: [Statistics of the fisheries of Wisconsin in 1899.] Report, 1901 (1902), p. 656, 722–725.

GULF STATES.

U. S. Bureau of Fisheries: Statistics of the fisheries of the Gulf States. Report, 1899 (1900), p. 105–169 incl. tables. *Doc. 420 issued Oct. 9, 1899.* F11–105

——— Statistics of the fisheries of the Gulf States, 1902. Report, 1903 (1905), p. 411–481 incl. tables. *Doc. 571 issued 1905.* F12–233

MIDDLE ATLANTIC STATES.

Smith, Hugh McCormick: [Statistics of the fisheries of the Middle Atlantic States in 1892 and 1893.] Report, 1893 (1895), p. 53–57.

——— A statistical report on the fisheries of the Middle Atlantic States. Bulletin 1894 (1895), vol. XIV, p. 339–467. *Doc. 296 issued May 23, 1895.* F15–54

Townsend, Charles Haskins: [Statistics of the fisheries of the Middle Atlantic States in 1897.] Report, 1899 (1900), p. CLIX–CLXI.

U. S. Bureau of Fisheries: [Statistics of the fisheries of the Middle Atlantic States.] Report, 1888–89 (1892), p. 323–351.

——— Statistics of the fisheries of the Middle Atlantic States. Report, 1900 (1901), p. 195–311 incl. tables. *Doc. 453 issued Apr. 12, 1901.* F11–73

——— Statistics of the fisheries of the Middle Atlantic States. Report, 1902 (1904), p. 433–540 incl. tables. *Doc. 540 issued Oct. 27, 1903.* F11–7

——— Statistics of the fisheries of the Middle Atlantic States for 1904. Report and special papers, 1905 (1907), 122 p. *Doc. 609 issued Feb. 19, 1907.* 7–35091

NEW ENGLAND STATES.

Smith, Hugh McCormick: [Statistics of the fisheries of the New England coast in 1890.] Report, 1889–1891 (1893), p. 175–177.

——— [Statistics of the fisheries of the New England States in 1892.] Report, 1894 (1896), p. 122–147.

Townsend, Charles Haskins: [Statistics of the fisheries of the New England States in 1898.] Report, 1900 (1901), p. 174–177.

U. S. Bureau of Fisheries: Statistics of the fish and fisheries on the south shore of New England. Report 1871 and 1872 (1873), p. 173–181. F16–59

——— [Statistics of the fisheries of the New England States in 1887 and 1888.] Report, 1888–89 (1892), p. 286–322.

——— Statistics of the fisheries of the New England States. Report, 1900 (1901), p. 311–386 incl. tables. *Doc. 454 issued Apr. 12, 1901.* F11–72

——— [The fisheries of the New England States in 1902.] Report, 1904 (1905), p. 130–131.

U. S. Bureau of Fisheries: Statistics of the fisheries of the New England States, 1902. (Earlier publications of the Bureau relating to the fisheries of the New England States, p. 247.) Report, 1904 (1905), p. 245–325 incl. tables. *Doc. 575 issued July 14, 1905.* F14–136

——— Statistics of the fisheries of the New England States for 1905. Report and special papers, 1906 (1908), 93 p. *Doc. 620 issued July 29, 1907.* 7–35283

PACIFIC COAST STATES.

Smith, Hugh McCormick: [Statistics of the fisheries of the Pacific coast in 1888 and 1889.] Report, 1889–1891 (1893), p. 174–175.

——— [Statistics of the fisheries of the Pacific States in 1892.] Report 1893 (1895), p. 60–62.

——— [Statistics of the fisheries of the Pacific States in 1896.] Report, 1897 (1898), p. CXXXVII–CXXXIX.

Statistics of whaling, cod-fishing, and salmon-packing on the Pacific coast. Bulletin, 1886 (1887), vol. VI, p. 89–90 incl. tables. F18–544

U. S. Bureau of Fisheries: [Statistical review of the fisheries of the Pacific Coast States in 1887 and 1888.] Report, 1888–89 (1892), p. 374–378.

——— [Statistics of the fisheries of the Pacific Coast States in 1915.] Report, 1917 (1919), p. 34–39.

SOUTH ATLANTIC STATES.

Townsend, Charles Haskins: [Statistics of the fisheries of the South Atlantic States in 1897.] Report, 1898 (1899), p. CLVII–CLIX.

U. S. Bureau of Fisheries: [Statistical review of the fisheries of the South Atlantic States.] Report, 1888–89 (1892), p. 351–361.

——— Statistics of the fisheries of the South Atlantic States. Report, 1899 (1900), p. 171–227 incl. tables. *Doc. 421 issued Oct. 9, 1899.* F11–106

——— Statistics of the fisheries of the South Atlantic States, 1902. Report, 1903 (1905), p. 343–410 incl. tables. *Doc. 570 issued 1905.* F12–232

——— [Statistics of the fisheries of the South Atlantic States in 1902.] Report, 1904 (1905), p. 131–132.

GREAT LAKES.

Milner, James W.: [Statistics of the fisheries of the Great Lakes for the year 1872.] Report, 1872 and 1873 (1874), p. 6–7.

Smith, Hugh McCormick, and **Merwin-Marie Snell:** Review of the fisheries of the Great Lakes in 1885. Report, 1887 (1891), p. 3–334, LXIV pl. (partly fold.) fold. maps. *Doc. 140 issued Mar. 2, 1891.* F11–330

Townsend, Charles Haskins: [Statistics of the fisheries of Lake Ontario in 1897.] Report, 1898 (1899), p. CLII–CLVI.

——— [Statistics of the fisheries of Lakes Erie and Ontario in 1899.] Report, 1900 (1901), p. 164–166.

——— [Statistics of the fisheries of the Great Lakes in 1899.] Report, 1901 (1902), p. 152–154.

U. S. Bureau of Fisheries: Statistics of the fisheries of the Great Lakes. Report, 1901 (1902), p. 575–657. *Doc. 506 issued Oct. 24, 1902.* F11–29

——— Statistics of the fisheries of the Great Lakes in 1903. Report, 1904 (1905), p. 643–731. *Doc. 593 issued Dec. 30, 1905.* F12–384

——— [A statistical canvass of the fisheries of the Great Lakes, including Lake of the Woods, Rainy Lake, and Lakes Kabetogama and La Croix, during 1917.] Appendix X, Report, 1918 (1920), p. 42–47 incl. tables.

MISSISSIPPI RIVER.

U. S. Bureau of Fisheries: Statistics of the fisheries of the Mississippi River and tributaries. Report, 1901 (1902), p. 659–740. *Doc. 507 issued Oct. 25, 1902.* F11–30

——— [Statistics of the fisheries of Lake Pepin and Lake Cooper (Mississippi River) in 1914.] Report, 1916 (1917), p. 58–60.

CANADA.

BRITISH COLUMBIA.

Statistics of the fisheries of the province of British Columbia for 1884, 1885, 1886. Bulletin, 1885 (1885), vol. V, p. 424–425; 1886 (1886), vol. VI, p. 110–111; 1887 (1888), vol. VII, p. 24–25, 159–160, tables. F18–551

ATLANTIC OCEAN.

Dambeck, Carl: Statistics of the most important fisheries of the North Atlantic. Report, 1873–74 and 1874–75 (1876), p. 21–24. F16–3

EUROPE.

AUSTRIA.

Peyrer, Karl: Fishery statistics of Austria. Report, 1876 (1878), p. 601–603.

FRANCE.

Statistics of the sea fisheries of France for the year 1884 [and 1885]. Bulletin, 1886 (1887), vol. VI, p. 219–221, 305; 1887 (1887), p. 51–55. F13–582

NORWAY.

Juel, Niels: Statistics of the Loffoden fisheries. Report, 1878 (1880), p. 245–254; 1881 (1884), p. 533–610. F16–160

The **Norwegian** fisheries for 1883, with statistics for previous years. Report, 1883 (1885), p. 359–369. F20–165

Strõm, Boye: Extracts from Norwegian official statistics of fisheries for the year 1880. Report, 1881 (1884), p. 611–617. F16–333

——— Statistics of Norwegian fisheries in 1880. Report, 1884 (1886), p. 333–351. F20–167

——— Extracts from the Norwegian fishery statistics for 1884. Report, 1885 (1887), p. 313–323. F16–333

SWEDEN.

Lundberg, Rudolph: [Statistics of the Swedish fisheries and remarks on the importance of scientific investigations concerning them.] Report, 1885 (1887), p. 390–395.

Widegren, Hjalmar: Statistical data regarding the Swedish fisheries. Report, 1873–74 and 1874–75 (1876), p. 31–34. F16–5

SPECIAL FISHERIES.

CAPELAN.

Sars, George Ossian: [Statistics of the capelan fisheries.] Report, 1880 (1883), p. 170–172, 177.

HALIBUT.

U. S. Bureau of Fisheries: [Statistics of the Pacific halibut and cod fisheries in 1916.] Report, 1916 (1917), p. 96–97.

MACKEREL.

Clark, A. Howard: [Statistics of the inspection of mackerel from 1804 to 1880 in Maine, Massachusetts, and New Hampshire.] Report, 1881 (1884), p. 252–307.

Earll, R. Edward: [Statistics of the Spanish mackerel fishery of the United States.] Report, 1880 (1883), p. 415–416.

——— [Statistics of the mackerel fishery in 1880.] Report, 1881 (1884), p. 214–221.

Earll, R. Edward; W. A. Wilcox; David W. Low; and A. Howard Clark: Statistics of the mackerel fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. II, p. 304–313.

Low, D. W.: [Statistics of the mackerel fishery in the Gulf of St. Lawrence, 1873–1881.] Report, 1881 (1884), p. 520.

MENHADEN.

Goode, George Brown: [Circular relating to statistics of the American menhaden fishery.] Report, 1877 (1879), p. 268–271.

SHAD.

Smiley, Charles Wesley: Statistics of the shad-hatching operations conducted by the United States Fish commission in 1881. Report, 1881 (1884), p. 1107–1119 incl. tables. F16–346

Smiley, C. W.: Statistics of the shad-hatching operations conducted by the United States Fish commission in 1882. Report, 1882 (1884), p. 903–913. F16–329

U. S. Bureau of Fisheries: [Statistics of the shad and alewife industry of Chesapeake Bay and tributaries in 1915.] Report, 1916 (1917), p. 65–70.

——— [Statistics of the shad fishery of the Hudson River, 1915 and 1916.] Report, 1916 (1917), p. 76.

——— [Statistics of the shad fishery of the Hudson River in 1917.] Report, 1918 (1920), p. 72.

STURGEON.

Cobb, John Nathan: [The statistics of the sturgeon fishery of the Delaware River and Bay.] Report, 1899 (1900), p. 379–380.

FISHING GROUNDS.

UNITED STATES.

GENERAL.

Alexander, Alvin Burton; H. F. Moore; and W. C. Kendall: Otter-trawl fishery. (Banks: p. 14.) Appendix VI, Report, 1914 (1915), 97 p., illus., fold. chart, fold. pl. *Doc. 816 issued Apr. 17, 1915.* F15–40

Baird, Spencer Fullerton: [Fishing grounds of the United States.] Report, 1881 (1884), p. XXV–XXXI.

——— [Fishing grounds along the eastern coast of North America from the Straits of Florida to New Foundland.] Report, 1886 (1889), p. X–XIII.

——— [Fishing grounds of eastern North America.] Report, 1886 (1889), p. 85–103.

Cobb, John Nathan: The commercial fisheries of Alaska in 1905. (Fishing grounds: p. 7–8, 10–12, 16–17, 21.) Report and special papers, 1905 (1907). *Doc. 603 issued Oct. 16, 1906.* 6–35319

Collins, Joseph William: [Fishing grounds of the Pacific coast of the United States.] Report, 1888–89 (1892), p. 9–10, 28–29, 31, 33, 37–38, 45–46, 51–52, 58–59, 64, 72–73, 147, 163, 172–173, 180, 184, 186, 190, 191, 193–194, 203–204, 230–231, 237–238, 241.

——— Report on the discovery and investigation of fishing grounds made by the Fish commission steamer *Albatross* during a cruise along the Atlantic coast and in the Gulf of Mexico, with notes on the Gulf fisheries. Report, 1885 (1887), p. 217–311. *Doc. 119 issued Nov. 3, 1887.* F11–298

Collins, J. W., and Richard Rathbun: The sea fishing-grounds of the eastern coast of North America from Greenland to Mexico. *In* The fisheries and fishery industries of the United States. 1887. Sec. III, p. 5–78, 11 charts.

Endicott, C.: A good fishing ground in the south Indian Ocean. Bulletin, 1886 (1887), vol. VI, p. 80.

Johnston, Edward C.: Survey of the fishing grounds on the coasts of Washington and Oregon, in 1915. Appendix VI, Report, 1915 (1917), 20 p. incl. tables, 4 charts (part fold.). *Doc. 835 issued Nov. 9, 1916.* F16–332

Jordan, David Starr: The sea-fishing grounds of the Pacific coast of the United States, from the Straits of Fuca to Lower California. *In* The fisheries and fishery industries of the United States. 1887. Sec. III, p. 79–80.

Radcliffe, Lewis: The offshore fishing grounds of North Carolina. 6 p., illus. *Economic Circular 8 issued Feb. 25, 1914.* F14–120

Rathbun, Richard: [Report upon the inquiry respecting the fishing grounds of the Pacific and Atlantic coasts.] Report, 1888–1889 (1892), p. XLI–XLIII, XLVII–LXXVI.

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coasts of Washington and Oregon in 1914. Appendix VII, Report, 1914 (1915), 30 p., pl., fold. tab. [2], fold. charts. *Doc. 817 issued June 8, 1915.* F15–86

Smith, Hugh McCormick: [Fishing grounds off San Diego County, California.] Report, 1898 (1899), p. CXXXIX–CXL.

Wilcox, William A: [Fishing grounds of Indian River, Florida.] Report, 1896 (1898), p. 249–251.

NEW ENGLAND.

Baird, Spencer Fullerton: [Models of the fishing grounds of the eastern coast of New England for exhibition at the London fishery exposition.] Report, 1882 (1884), p. LIII.

Smith, Hugh McCormick: [Fishing grounds for fishery products landed at Boston.] Report, 1892 (1894), p. CLX–CLXIV.

——— [Georges Bank fishing-ground.] Report, 1893 (1895), p. 76–77.

GREAT LAKES.

Kumlien, Ludwig, and Frederick W. True: The fishing-grounds of the Great Lakes. *In* The fisheries and fishery industries of the United States. 1887. Sec. III, p. 117–131.

Smith, Hugh McCormick: [Fishing grounds of Lake Ontario.] Report, 1887 (1891), p. 306, 308, 311, 315, 319, 326–327.

——— [Fishing grounds of Lake Huron.] Report, 1892 (1894), p. 408–410.

——— [The fishing grounds of Lake Ontario.] Report, 1892 (1894), p. 444.

SPECIAL.

COD.

Cobb, John Nathan: Pacific cod fisheries. (Fishing grounds: p. 13–23.) Appendix IV, Report, 1915 (1917), 111 p. incl. tables, IX pl., fold. chart. *Doc. 830 issued Oct. 23, 1916.* F16–191

Earll, R. Edward: [Fishing grounds of the shore cod-fisheries of Cape Ann, Massachusetts.] Report, 1878 (1880), p. 692.

HADDOCK.

Goode, George Brown, and J. W. Collins: [Haddock fishing grounds.] Bulletin, 1881 (1882), vol. I, p. 226–227.

HALIBUT.

Alexander, Alvin Burton: Preliminary examination of halibut fishing grounds of the Pacific coast. Report and special papers, 1911 (1913), 56 p. *Doc. 763 issued July 22, 1912.* F12–203

Marsh, Millard Caleb, and John N. Cobb: Fisheries of Alaska in 1910. (Halibut grounds: p. 40–42.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Scudder, Newton Pratt: [The halibut fishing grounds—Davis' Strait.] Report, 1880 (1883), p. 193–195.

MACKEREL.

Earll, R. Edward: [Spanish mackerel fishing grounds.] Report, 1880 (1883), p. 406–407.

Goode, George Brown: [The mackerel fishing grounds.] Report, 1881 (1884), p. 172–173.

Smith, Hugh McCormick: [A voyage to the mackerel fishing grounds of Norway in 1891.] Report, 1894 (1896), p. 171–172.

——— [A voyage to the fishing grounds of Africa for mackerel in 1891.] Report, 1894 (1896), p. 171–172.

MENHADEN.

Greer, Rob Leon: The menhaden industry of the Atlantic coast. (Menhaden grounds: p. 10–11.) Appendix III, Report, 1914 (1915), 27 p., VII pl. (incl. front.). *Doc. 811 issued Apr. 7, 1915.* F15–39

——— The menhaden industry of the Atlantic coast. 30 p., VII pl. (incl. front.). *Doc. 811 reprinted with additions Oct. 18, 1917.* F17–263

SALMON.

Cobb, John Nathan: Salmon fisheries of the Pacific coast. (Fishing grounds: p. 12–22.) Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–303

STURGEON.

Cobb, John Nathan: [Sturgeon fishery grounds of Delaware River and Bay.] Report, 1899 (1900), p. 373.

FISH MARKETS.

EUROPE.

GERMANY.

Nuremberg carp exchange. Bulletin, 1885 (1885), vol. V, p. 428. F18–495

GREAT BRITAIN.

The fish supply of London. (Description of Billingsgate Market. Destruction of fish at Billingsgate Market.) Report, 1881 (1884), p. 643–661. F16–335

HAWAIIAN ISLANDS.

Cobb, John Nathan: [Fish markets and the handling of fishery products in the Hawaiian Islands.] Bulletin, 1903 (1905), vol. XXII, pt. II, p. 751–758.

FISH TRADE.

UNITED STATES.

GENERAL.

Blackford, Eugene Gilbert: [Salmon from Washington territory and shad from Florida and North Carolina.] Bulletin, 1886 (1887), vol. VI, p. 409–410.

Smiley, Charles W.: Method and results of an effort to collect statistics of the fish trade and consumption of fish throughout the United States. Bulletin, 1882 (1883), vol. II, p. 247–252. F12–361

——— Statistics of the imports and exports of fish, fish-oil, whalebone, etc., for ten years ending June 30, 1882. Bulletin, 1883 (1883), vol. III, p. 273–278 incl. tables. F18–134

——— Statistics of the United States imports and exports of fish, fish-oil, whalebone, the tonnage of fishing vessels, etc., for the year ending June 30, 1883–84. Report, 1883 (1885), p. 301–316; 1884 (1886), p. 241–263, tables. F17–26

Smith, Hugh McCormick: Note regarding the promotion of fishery trade between the United States and Japan. Report, 1904 (1905), p. 239–243. *Doc. 576 issued July 17, 1905.* F10–5

Stevenson, Charles Hugh: A review of the foreign fishery trade of the United States: Report, 1894 (1896), p. 431–571. *Doc. 325 issued 1896.* F11–191

Wallem, Frederik Meltzer[The fresh-fish trade of the United States. North, America as a market for imported fish products.] Report, 1878 (1880), p. 77–785 83–89.

CALIFORNIA.

Dall, William Healey: Notes on the fishing products exported from San Francisco, Cal., during the year 1883. Bulletin, 1884 (1884), vol. IV, p. 125–128. F18–245

Sacramento Record: [Shipment of marine products from San Francisco to China.] Bulletin, 1886 (1887), vol. VI, p. 131.

Smith, Hugh McCormick: [Market fish and the fish trade of San Francisco.] Bulletin, 1894 (1895), vol. XIV, p. 282–285.

DISTRICT OF COLUMBIA.

Smiley, Charles W.: Inspection of fish and other marine products in the District of Columbia, 1879 to 1883, inclusive. Bulletin, 1884 (1884), vol. IV, p. 1–12. F13–77

——— Inspection of fish and other marine products in the District of Columbia. Bulletin, 1886 (1887), vol. VI, p. 47–48. F18–530

FLORIDA.

Wilcox, William A.: [Fish trade of Indian River, Florida.] Report, 1896 (1898), p. 257–258.

GEORGIA.

Carrington, William T.: [Fish and oyster trade of Brashear, La.] Bulletin, 1886 (1887), vol. VI, p. 141.

U. S. Bureau of Fisheries: [Notes on the wholesale fish trade of Georgia.] Report, 1899 (1900), p. 215–216.

MAINE.

Fish bureau in Portland, Maine. Bulletin, 1884 (1884), vol. IV, p. 310.

MASSACHUSETTS.

U. S. Bureau of Fisheries: [The wholesale fish trade of Boston and Gloucester, Mass.] Report, 1900 (1901), p. 361–363.

NEW YORK.

Blackford, E. G.: [Salmon from Nova Scotia, Massachusetts coast, and the Columbia River in New York market.] Bulletin, 1885 (1885), vol. V, p. 95.

New York Market Index and Journal: Report for 1879 and 1880 of the sale of fish in Fulton Market, New York. Bulletin, 1883 (1883), vol. III, p. 426–427.

GULF STATES.

U. S. Bureau of Fisheries: [The wholesale fishery trade of the Gulf States.] Report, 1899 (1900), p. 134–135, 141–144, 158–159, 169.

——— [The wholesale fishery trade of the Gulf States, 1902.] Report, 1903 (1905), p. 450–451, 462–463.

MIDDLE ATLANTIC STATES.

U. S. Bureau of Fisheries: [The wholesale fishery trade of the Middle Atlantic States.] Report, 1900 (1901), p. 254, 262, 267, 285–287, 309–310.

——— Statistics of the fisheries of the Middle Atlantic States for 1904. (Wholesale fishery trade: p. 62, 88, 121, 122.) Report and special papers, 1905 (1907), p. 62, 88, 121–122. *Doc. 609 issued Feb. 19, 1907.* 7–35891

NEW ENGLAND STATES.

U. S. Bureau of Fisheries: [The wholesale fish trade of the New England States.] Report, 1900 (1901), p. 338–339, 361–363, 378–379, 386.

PACIFIC COAST.

Collins, J. W.: [Market for fish and fish trade of the Pacific coast of the United States.] Report, 1888–89 (1892), p. 40–41, 47–49, 54–55, 87, 118–125, 157.

Dall, William Healey: Notes on the Pacific coast trade in shells, shrimp, cod, and salmon. Bulletin, 1883 (1883), vol. III, p. 425. F18–160

Wilcox, William A.: [The fish trade of the Pacific coast fisheries. Report, 1893 (1895), p. 208–211, 254.

——— The commercial fisheries of the Pacific coast States in 1904. (Wholesale fishery trade: p. 23–29.) Report and special papers, 1905 (1907). *Doc. 612 issued Feb. 25, 1907.* 7–35100

SOUTH ATLANTIC STATES.

U. S. Bureau of Fisheries: [The wholesale fishery trade of the South Atlantic States in 1902.] Report, 1903 (1905), p. 385, 397, 409.

GREAT LAKES.

Smith, Hugh McCormick: [The fish trade of Lake Erie.] Report, 1887 (1891), p. 237–238, 244, 248–249, 254, 269–270, 273, 275–276, 283, 287–288.

——— [Fish trade of Lake Huron, in 1885.] Report, 1887 (1891), p. 206, 214, 217–218, 221, 222.

——— [Fish trade of Lake Michigan in 1885.] Report, 1887 (1891), p. 94, 102, 111, 121–123, 130–131, 144, 148, 153, 167–168, 175, 186, 189, 198–199, 201.

——— [The fish trade of Lake Ontario.] Report, 1887 (1891), p. 323, 325.

U. S. Bureau of Fisheries: [The wholesale fishery trade of the Great Lakes in 1899.] Report, 1901 (1902), p. 596, 614–616, 626–627, 642–644.

——— [The wholesale fishery trade of the Great Lakes in 1903.] Report, 1904 (1905), p. 662–663, 682–683, 699, 702–703, 714–716.

GULF OF MEXICO.

Collins, J. W.: [Fish trade of the Gulf of Mexico, Key West, and Cuba.] Report, 1885 (1887), p. 271–273.

PORTO RICO.

Wilcox, William A.: Notes on the foreign fishery trade and local fisheries of Porto Rico. Report, 1899 (1900), 34 p. incl. tables, illus., 6 pl. *Doc. 418 issued Oct. 4, 1899.* F11–104

——— [Fishery products imported by Porto Rico.] Bulletin, 1900 (1902), vol. XX, pt. I, p. 41–48.

——— The fisheries and fish trade of Porto Rico in 1902. Report, 1902 (1904), p. 367–395 incl. tables. *Doc. 539 issued Sept. 19, 1903.* F11–5

EUROPE.

GERMANY.

Smith: [Imports and exports of Germany.] Bulletin, 1884 (1884), vol. IV, p. 366.

GREAT BRITAIN.

The **fish** supply of London. Report, 1881 (1884), p. 643–661. F16–335

London, Journal of the National Fish Culture Association: [Fish conveyed inland by railways in Great Britain.] Bulletin, 1886 (1887), vol. VI, p. 415.

NORWAY.

[**Exports** of fishery products from Norway.] Bulletin, 1886 (1887), vol. VI, p. 306.

Wallem, F. M.: Exports of the fish-oil from Norway, 1878 1882. Bulletin, 1883 (1883), vol. III, p. 240; 1884 (1884), vol. IV, p. 382. F18–129, F18–340

WHITE SEA.

Schultz, Alexander: [The fish trade of the White Sea, the Arctic Ocean, and Caspian Sea.] Report, 1873–74 and 1874–75 (1876), p. 51–52, 90–92.

OCEANICA.

AUSTRALIA.

Kohlo, Charles: [Fish and oysters for New South Wales.] Bulletin, 1884 (1884), vol. IV, p. 365.

HAWAIIAN ISLANDS.

Cobb, J. N.: [Fish trade, Hawaiian Islands.] Report, 1901 (1902), p. 442–451; 1904 (1905), p. 454–455.

SPECIAL.

CARP.

Kottbus. Handelskammer: The Cottbus carp trade. Bulletin, 1882 (1883), vol. II, p. 158. F18–94

Nicklas, Carl: [The sale of fish at the carp exchange at Cottbus, Province of Brandenburg, Prussia.] Report, 1884 (1886), p. 629.

[**Price** of carp in German markets in 1884.] Bulletin, 1886 (1887), vol. VI, p. 458.

Smith, Amos: [Prices of carp.] Bulletin, 1885 (1885) vol. V, p. 102.

Townsend, Charles Haskins: [The wholesale trade in carp in New York City. The carp trade in general.] Report, 1902 (1904), p. 153.

U. S. Bureau of Fisheries: Nuremberg carp exchange. Bulletin, 1885 (1885), vol. V, p. 428. F18–495

Zenk, F.: Prices of carp, tench, and goldorfe in Germany. Bulletin, 1883 (1883), vol. III, p. 406. F18–152

COD.

Cobb, John Nathan: Pacific cod fisheries. (Market in the West Indies, Hawaii, Mexico: p. 72–75.) Appendix IV, Report, 1915 (1917), 111 p. *Doc. 830 issued Oct. 23, 1916.* F16–191

Dambeck, Carl: [Cod-fish trade—Norway, Denmark, Sweden, Germany, and Newfoundland.] Report, 1877 (1879), p. 553–557.

Earll, R. E.: [Disposition of Cape Ann cod.] Report, 1878 (1880,) p. 700–704.

Friele, M.: [The codfish trade of Norway in 1877.] Report, 1877 (1879), p. 722–723.

German Fishery Association: [Codfish in the great markets of the world.] Bulletin, 1886 (1887), vol. VI, p. 310–311.

GOLDFISH.

[**Goldfish** trade of C. Wagner at Oldenberg, Germany.] Report, 1878, (1880), p. 683-684.

HERRING.

Lundberg, R.: [Herring fish trade of Sweden.] Report, 1884 (1886), p. 373 374.

SALMON.

Cobb, John Nathan: Salmon fisheries of the Pacific coast. (Trade with outlying possessions: pp. 138–153.) Report and special papers, 1910 (1911), 180 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

Scotch Fisheries Improvement Association: [Salmon sold at Billingsgate.] Bulletin, 1886 (1887), vol. VI, p. 139.

SHAD.

Wright, Harrison: [The early shad fisheries of the north branch of the Susquehanna River—Country supply and trade.] Report, 1881 (1884), p. 623–624.

MISCELLANEOUS.

Donnelly, Frank L.: [Sales of fish.] Bulletin, 1884 (1884), vol. IV, p. 319.

Hughes, Smith E.: Experiments in penning sea fish. Bulletin, 1884 (1884), vol. IV, p. 377–380. F18–337

Paulsen, Paul George: The world's market for klip fish, roe, and herring. Bulletin, 1884 (1884), vol. IV, p. 392–393. F18–347

Stange, J.: Fish becoming blue and rigid during transportation. Bulletin, 1886 (1887), vol. VI, p. 64. F18–53

U. S. Bureau of Fisheries: Transportation of live fish. Bulletin, 1882 (1883), vol. II, p. 95–102, illus. F18–80

The **weight** of fishes in different conditions. Bulletin, 1884 (1884), vol. IV, p. 391. F18–346

FISHWAYS.

UNITED STATES.

GENERAL.

Atkins, Charles G.: On fishways. Report, 1872–73 (1874), p. 591–616, pl. XX–XXXIV. F15–122

Baird, Spencer Fullerton: [The increase of food fishes by the use of fishways.] Report, 1885 (1887), p. LXXIII.

Bayer, Hector von: Fishways. (Authorities consulted; p. 1055.) Bulletin, 1908 (1910), vol. XXVIII, p. 1041–1057, diagrs. *Doc. 707 issued Apr. 19, 1910.* 10–35568

Coker, Robert Ervin: [The question of a practical and efficient fishway.] Appendix VIII, Report, 1913 (1914), p. 18–21.

——— The question of fishways. 6 p. *Economic Circular 24 issued May 8, 1917.* F17–187

McDonald, Marshall: Report of Marshall McDonald, submitting plans and specifications of the fishways for the Great Falls of the Potomac River. Judd & Detweiler, 1884, 22 p., *Doc. 72 issued June 5, 1884.* F11–273

———A new system of fishway building. Report, 1882 (1884), p. 43–52. *Doc. 80 issued Aug. 15, 1884.* F11–269

——— [Erection of fishways at the Great Falls of the Potomac] Report, 1889–1891 (1893) p. 68–69.

Nowicki, M.: Anton Pintsch's movable fishway. Bulletin, 1884 (1884), vol. IV, p. 209–212. F13–99

U. S. Bureau of Fisheries: Obstructions to the ascent of fish in certain rivers. [Communication from E. M. Stillwell, M. C. Edmunds, M. McKennie, J. F. Ingalls, James W. Milner.] Report, 1872–73 (1874), p. 617–633. F15–123

CALIFORNIA.

Throckmorton, S. R.: Description of the fishway in Pitt River, California. Bulletin, 1881 (1882), vol. I, p. 202–204. F18–37

ILLINOIS.

[Fishways in Illinois.] Bulletin, 1885 (1885), vol. V, p. 343.

MONTANA.

Waterbury, E. B.: Obstructions to salmon in Pend d'Oreille River, Montana, requiring a fishway or removal of falls. Bulletin, 1883 (1883), vol. III, p. 421–423. F18–158

GERMANY.

Keller, H.: Freedom of migration for fish in Germany. Bulletin, 1886 (1887), vol. VI, p. 113–116. F18–553

FISHERIES CONSIDERED GEOGRAPHICALLY.

UNITED STATES.

GENERAL.

Anderssen, Joakim: Report on the department of fisheries in the World's exposition in Philadelphia, 1876. Report, 1878 (1880), p. 47–71. F16–154

Baird, Spencer Fullerton, and Theodore Gill: Memoranda of inquiry relative to the food-fishes of the United States. Report, 1871–72 (1873), 3 p. *Doc. 1 issued 1872 (?).* F12–212

——— Questions relative to the food-fishes of the United States. Report, 1871–72 (1873), p. 3–6. *Doc. 2 issued 1872 (?).* F12–213

——— The sea fisheries of eastern North America. Report, 1886 (1889), 224 p. *Doc. 125 issued May 14, 1889.* F11–253

Collins, J. W.: [Attempts to use the beam trawl in the fisheries of the United States.] Bulletin, 1887 (1889), vol. VII, p. 400–404.

——— [Notice of special matters affecting the fisheries of the United States.] Report, 1887 (1891), p. 353–359; 1888–1889 (1892), p. CVIII–CXIX.

Field, Irving A.: Unutilized fishes and their relation to the fishing industries. Report and special papers, 1906 (1908), 50 p., pl. *Doc. 622 issued Sept. 10, 1907.* 7–35352

Goode, George Brown: Plan of inquiry into the history and present condition of the fisheries of the United States. Report, 1880 (1883), p. 3–52. F16–285

——— The food fishes of the United States . . . with discussions of the Pacific species by D. S. Jordan and T. H. Bean; notes on the fishes of the Gulf of Mexico, by S. Stearns; and contributions from J. W. Collins, N. E. Atwood, M. McDonald, R. E. Earll, L. Kumlien, and other authorities. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 163–182.

——— The status of the United States Fish commission in 1884. A review of what has been accomplished in fish culture, and the investigation of the American fisheries. Report, 1884 (1886), 42 p. F11–273

——— [Methods to be adopted for the improvement of the fisheries of the United States.] Report, 1884 (1886), p. 1148–1152.

——— The fisheries and fishery industries of the United States. Prepared through the cooperation of the Commissioner of fisheries and the Superintendent of the tenth census. (*Contents.*—Sec. I. Natural history of useful aquatic animals, by G. B. Goode, J. A. Allen, H. W. Elliot, F. W. True, E. Ingersoll, J. A. Ryder, R. Rathbun. Sec. II. A geographical review of the fisheries industries and fishing communities for the year 1880, by R. E. Earll, W. A. Wilcox, A. H. Clark, F. Mather, J. W. Collins, M. McDonald, S. Stearns, D. S. Jordan, F. W. True. Sec. III. The fishing grounds of North America, by R. Rathbun, J. W. Collins, D. S. Jordan, T. H. Bean, L. Kumlien, F. W. True. Sec. IV. The fishermen of the United States, by G. B. Goode, J. W. Collins. Sec. V. History and methods of the fisheries, by G. B. Goode, J. W. Collins, N. P. Scudder, T. H. Bean, A. H. Clark, R. E. Earll, S. Stearns, F. W. True, M. McDonald, W. A. Wilcox, C. G. Atkins, D. S. Jordan, C. H. Gilbert, L. Kumlien, A. H. Clark, J. T. Brown, H. W. Elliott, J. G. Swan, E. Ingersoll, R. Rathbun.) 1884–1887, 5 sections in 7 vols., plates, charts. F20–35

Perce, H. W.: National aspects of angling and protection of game fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 193–198. *Doc. 651 issued Jan. 31, 1910.* 10–35136

Rathbun, Richard: [Investigation of fisheries in waters contiguous to Canada and the United States.] Report, 1893 (1895), p. 20–22; 1894 (1896), p. 87–89; 1895 (1896), p. 77–79; 1896 (1898), p. 102–103.

Smiley, Charles Wesley: The principal river fisheries of the United States, with an estimate of the catch for 1880. Report, 1883 (1885), p. 281–300. F17–25

Smith, Hugh McCormick: The fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries. Bulletin, 1892 (1894), vol. XII, p. 299–355, pl. LXXII–XCI. *Doc. 226 issued Nov. 9, 1895.* F12–164

U. S. Bureau of Fisheries: [The otter-trawl fishery from 1912 to 1915.] Report, 1915 (1917), p. 60–62.

U. S. Bureau of Fisheries: Report on statistics and methods of the fisheries. Report, 1889-91 (1893), p. 173–204; 1892 (1894), p. 133–191; 1893 (1895), p. 52–77; 1894 (1896), p. 115–175; 1895 (1896), p. 93–123; 1896 (1898), p. 119–145; 1897 (1898), p. 125–146, (by H. M. Smith); 1898 (1899), p. 147–175; 1899 (1900), p. 147–163; 1900 (1901), p. 163-184; 1901 (1902), p. 141–166; 1902 (1904), p. 143–160; (by C. H. Townsend); 1903 (1905), p. 101–122, (by B. W. Evermann): 1904 (1905), p. 121–162, (by. A. B. Alexander).

——— Fishery industries of the United States. Report of the division of statistics and methods of the fisheries * * * (by Lewis Radcliffe). Appendix X, Report, 1918 (1920), 167 p. *Doc. 875 issued Nov. 15, 1919;* Appendix X, Report, 1919 (1921), 191 p. *Doc. 892 issued Dec. 10, 1920.* F 19–41

Wallen, Fredrik Meltzer: Report on the American fisheries. Report, 1878 (1880), p. 75–115. F16–155

ALABAMA.

Collins, Joseph William, and Hugh McCormick Smith: [Fisheries of Alabama.] Bulletin, 1891 (1893), vol. XI, p. 138–144.

Smith, Hugh McCormick: [The fisheries of Alabama.] Report, 1895 (1896), p. 106.

ALASKA.

Alexander, Alvin, B.: [Notes on fishery investigations in Alaska by the *Albatross*, in 1894.] Report, 1895 (1896), p. 139–145.

Bean, T. H.: The fishery resources and fishing grounds of Alaska. *In* The fisheries and fishery industries of the United States. 1887. Sec. III, p. 81–115, 4 pl.

Cobb, John Nathan: The commercial fisheries of Alaska. Report and special papers, 1905 (1907), 46 p. *Doc. 603 issued Oct. 16, 1906.* 6–35319

——— Pacific cod fisheries. (Bibliography: p. 108–111.) Appendix IV, Report, 1915 (1917), 111 p. *Doc. 830 issued Oct. 23, 1916.* F16–191

Evermann, B. W.: [Alaska salmon investigations.] Report, 1904 (1905), p. 87–102.

French, Peter: [Note on fisheries of Alaska.] Bulletin, 1886 (1887), vol. VI, p. 462.

Krause, Karl E. H.: Cod and halibut fisheries near the Shumagin Islands. Bulletin, 1881 (1882), vol. I, p. 259–260. F18–47

Schwatka: [The fisheries of Alaska.] Bulletin, 1886 (1887), vol. VI, p. 462–463.

U. S. Bureau of Fisheries: The fisheries of Alaska in 1906. (Report on the fisheries of Alaska, by John N. Cobb. Report on inspection of the salmon fisheries, by Howard M. Kutchin.) Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued May 16, 1907.* 7–35263

——— The fisheries of Alaska in 1907. By Millard C. Marsh and John N. Cobb. Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7–35263

——— The fisheries of Alaska in 1908. By M. C. Marsh and J. N. Cobb. Report and special papers, 1908 (1910), 78 p. *Doc. 645 issued Apr. 17, 1909.* 7–35263

——— The fisheries of Alaska in 1909. By M. C. Marsh and J. N. Cobb. Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20; 1910.* 7–35263

——— The fisheries of Alaska in 1910. By M. C. Marsh and J. N. Cobb. Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

——— Alaska fisheries and fur industries in 1911. (General administrative report, by B. W. Evermann and F. M. Chamberlain. Statistics of the fisheries of Alaska for 1911, by J. N. Cobb and F. M. Chamberlain. Fish culture in Alaska, by W. T. Bower. Fur-seal service in 1911, by W. I. Lembkey.) Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

——— Fishery and fur industries of Alaska in 1912. (General administrative report, by B. W. Evermann. Fishery industries, by Fred M. Chamberlain and Ward T. Bower. Fur-seal service, by Walter I. Lembkey. Minor fur industries, by Harry J. Christoffers and Lee R. Dice.) Report and special papers, 1912 (1914), 123 p., pl. *Doc. 780 issued Nov. 16, 1913.* F12–388

——— Alaska fisheries and fur industries in 1913. (General administrative report, by B. W. Evermann. Fishery industries, by Ward T. Bower and Harry Clifford Fassett. Fur-seal service, by Walter I. Lembkey.) Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

——— Alaska fisheries and fur industries in 1914. By Ward T. Bower and Henry D. Aller. Appendix IX, Report, 1914 (1915), 89 p. *Doc. 819 issued Sept. 23, 1915.* F12–388

——— Alaska fisheries and fur industries in 1915. By Ward T. Bower and Henry D. Aller. Appendix III, Report, 1915 (1917), 140 p., illus. *Doc. 834 issued Jan. 6, 1917.* F12–388

U. S. Bureau of Fisheries: Alaska fisheries and fur industries in 1916. By Ward T. Bower and Henry D. Aller. Appendix II, Report, 1916 (1917), 118 p. *Doc. 838 issued Aug. 14, 1917.* F 12-388

——— Alaska fisheries and fur industries in 1917. By Ward T. Bower and Henry D. Aller. Appendix II, Report, 1917 (1919), 123 p. *Doc. 847 issued Dec. 28, 1918.* F12-388

——— Alaska fisheries and fur industries in 1918. By Ward T. Bower. Appendix VII, Report, 1918 (1920), 128 p., X pl. *Doc. 872 issued Dec. 8, 1919.* F12-388

——— Alaska fisheries and fur industries in 1919. By Ward T. Bower. Appendix IX, Report, 1919 (1921), 160 p. *Doc. 891 issued Dec. 11, 1920.* F12-388

Wilcox, Wiliam A.: [Growth of the fishery industry in Alaska.] Report, 1893 (1895), p. 297-304.

ARKANSAS.

Lawrence, George W.: [Letter referring to the presence of shad in the Ouachita River, Hot Springs County, Arkansas, in 1872.] Report, 1872 and 1873 (1874), p. 392-393.

CALIFORNIA.

Buckingham, R. H.: [Fish in California.] Bulletin, 1886 (1887), vol. VI, p. 415.

Holder, Charles Frederick: Sport fishing in California and Florida. Bulletin, 1908 (1910), vol. XXVIII, p. 199-207, VI pl. *Doc. 652 issued Feb. 28, 1910.* 10-35268

Smith, H. M.: [Lake fisheries of California, 1894-1895.] Report, 1896 (1898), p. 128.

——— [Fisheries of interior waters of California, with especial reference to Lake Tahoe.] Report, 1896 (1898), p. 572-573.

Tanner, Z. L.: [Investigations of the fisheries of California by the *Albatross*, 1889 to 1891.] Report, 1889-91 (1893), p. 215-226, 271-279.

Townsend, Charles Haskins: [Fisheries of San Francisco in 1898 and 1899.] Report, 1899 (1900), p. CL-CLII.

U. S. Bureau of Fisheries: Correspondence relating to the San Joaquin River and its fishes. Report, 1873-74 and 1874-75 (1876), p. 479-483. F16-24

Wilcox, William A.: [The fisheries of California in 1889, 1890, 1891, and 1892.] Report 1893 (1895), p. 147-212.

——— [Fisheries of California in 1895.] Report, 1896 (1898), p. 575-590, 633-659.

——— [Fisheries of California in 1899.] Report, 1901 (1902), p. 549-574.

COLORADO.

Evermann, Barton Warren: [The fisheries of Colorado in 1900.] Report, 1903 (1905), p. 115-118.

Smith, H. M.: [The fisheries of Colorado in 1889.] Report, 1896 (1898), p. 126-127.

CONNECTICUT.

Clark, A. Howard: The coast of Connecticut and its fisheries. Notes on the general fisheries, gathered by W. A. Wilcox and Fred Mather. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. V, p. 311-340.

DELAWARE.

Collins, Joseph William: Delaware and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. IX, p. 407-419.

[**Fish** factories on Delaware Bay offensive.] Bulletin, 1885 (1885), vol. V, p. 86.

FLORIDA.

Adams A. C., and William Converse Kendall: Report upon an investigation of the fishing grounds off the west coast of Florida. Bulletin, 1889 (1891), vol. IX, p. 289-312, II illus., pl. CXI (fold.). *Doc. 162 issued July 24, 1891.* F12-150

Collins, Joseph William: [Notes on the fisheries of Key West and western Florida in 1885.] Report, 1885 (1887), p. 246-311.

Collins, Joseph William, and Hugh McCormick Smith: [Fisheries of Florida.] Bulletin, 1891 (1893), vol. XI, p. 108-138.

Detwiler, John Y.: Notes on the fishing industry of eastern Florida Bulletin, 1897 (1898), vol. XVII, p. 309-312. *Doc. 386 issued Aug. 8, 1898.* F12-110

Fisher, F. B.: Fishing and fish-culture in Florida. Bulletin, 1881 (1882), vol. I, p. 251.

Holder, Charles Frederick: Sport fishing in California and Florida. Bulletin, 1908 (1910), vol. XXVIII, p. 199–207, VI pl. *Doc. 652 issued Feb 28, 1910.* 10–35268

Rathbun, Richard: [Fishery investigations in Indian River.] Report, 1896 (1898), p. 112–113.

Shepard, Joseph: [Note on the fisheries of St. Marys River.] Bulletin, 1886 (1887), vol. VI, p. 461.

Smith, Hugh McCormick: [Fisheries of Florida.] Bulletin, 1891 (1893), vol. XI, p. 333–345.

Stearns, Silas: On the position and character of the fishing grounds of the Gulf of Mexico. Bulletin, 1884 (1884), vol. IV, p. 289–290. F18–313

——— The fisheries of Pensacola, Florida. Bulletin, 1885 (1885), vol. V, p. 245–247. F18–419

——— Notes on the fisheries of Pensacola, Fla. Bulletin, 1886 (1887), vol. VI, p. 76–78. F18–538

——— Some of the fisheries of western Florida. Bulletin, 1886 (1887), vol. VI, p. 465–467. F18–631

U. S. Bureau of Fisheries: Report on the fisheries of Indian River, Florida, transmitted to the United States Senate by the Commissioner of fish and fisheries, January 5, 1897. (*Contents.*—Letter of transmittal, by J. J. Brice. Indian River and its fisheries, by B. W. Evermann and B. A. Bean. Commercial fisheries of Indian River, Florida, by W. A. Wilcox.) Report, 1896 (1898), p. 223–262, pl. 23–59. *Doc. 341 issued June 16, 1897.* F11–179

——— Report on the fish and fisheries of the coastal waters of Florida transmitted to the United States Senate by the commissioner of fish and fisheries, January 28, 1897. Report, 1896 (1898), p. 263–342. *Doc. 342 issued Feb. 25, 1898.* F11–180

GEORGIA.

Smith, Hugh McCormick: [Fisheries of Georgia.] Bulletin, 1891 (1893), vol. XI, p. 319–332.

ILLINOIS.

Nelson, Edward William: Fisheries of Chicago and vicinity. Report, 1875-76 (1878), p. 783–800, illus. F16–69

LOUISIANA.

Collins, Joseph William, and Hugh McCormick Smith: [The fisheries of Louisiana.] Bulletin, 1891 (1893), vol. XI, p. 155–171.

Smith, Hugh McCormick: [The fisheries of Louisiana in 1894.] Report, 1895 (1896), p. 104–105.

——— [Investigation of the fisheries of Louisiana in 1897.] Report, 1897 (1898), p. XCVIII–XCIX.

MAINE.

Atkins, C. G.: [The river fisheries of Maine.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. XII, p. 673–728.

Earll, R. Edward: The coast of Maine and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. I, p. 3–102.

Smith, Hugh McCormick: [The fisheries of Passamaquoddy Bay, Maine, in 1896.] Report, 1896 (1898), p. 129.

MARYLAND.

Earll, R. Edward: Maryland and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. X, p. 421–448.

MASSACHUSETTS.

Anderssen, Joakim: [Note on the fisheries exhibit of Massachusetts at the World's exposition in Philadelphia, 1876.] Report, 1878 (1880), p. 52.

Atwood, Nathaniel F.: Fisheries on the coast of Massachusetts. Remarks of Mr. Atwood of the cape district in relation to the petition to prohibit net and seine fisheries. Report, 1871–72 (1873), p. 117–124. F16–54

Baird, Spencer Fullerton: [Testimony and information from Vinal N. Edwards relative to the condition of the fisheries of Massachusetts in 1872.] Report, 1871–72 (1873), p. 182–195.

Clark, A. Howard: The fisheries of Massachusetts . . . Material for whale fishery and for Gloucester district gathered by A. Howard Clark; for Newburyport, Salem, Marblehead, Boston, Plymouth, New Bedford, and Fall River districts, by W. A. Wilcox; for Barnstable, Nantucket, and Edgartown districts, by F. W. True. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. III, p. 113–280.

Elliott, James W.: [Mackerel, codfish, herring, etc., off northeastern Massachusetts.] Bulletin, 1887 (1889), vol. VII, p. 33–34.

Lyman, Theodore: On the possible exhaustion of the sea-fisheries of Massachusetts. Report, 1871–72 (1873), p. 112–116. F16–53

Martin, S. J.: Some of the early results of the introduction of cod gill-nets at Gloucester, Massachusetts, 1880–81. Bulletin, 1883 (1883), vol. III, p. 153–158. F20–137

Nye, Willard: Notes on the fisheries of Buzzard's Bay and vicinity. Bulletin, 1887 (1889), vol. VII, p. 160. F18–665

U. S. Bureau of Fisheries: [Consideration of the fisheries of Massachusetts in a conference of the United States commissioner with commissioners of Rhode Island and Massachusetts.] Report, 1871–72 (1873), p. 125–131.

——— Notes on the fisheries of Gloucester, Massachusetts. Bulletin, 1881 (1882), vol. I, p. 66, 263, 265–266, 268, 381, 394–395, 419–420, 425–427; 1882 (1883), vol. II, p. 15–18, 91–93; 1883 (1883), vol. III, p. 162–178, 297–300; 1884 (1884), vol. IV, p. 89–96, 129–135, 191–193, 249–255, 401–411, 444–448; 1885 (1885), vol. V, p. 49–51, 57–63, 203–208; 1887 (1889), vol. VII, p. 66–71, 73–80. F18–654

Wilcox, W. A., and Frederick W. True: [The river fisheries of Massachusetts and New Hampshire.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. XII, p. 667–673.

MICHIGAN.

Gauthier, C. W.: [Fish transported from Duck Island to Detroit.] Bulletin, 1886 (1887), vol. VI, p. 408.

MISSISSIPPI.

Collins, Joseph William, and Hugh McCormick Smith: [Fisheries of Mississippi.] Bulletin, 1891 (1893), vol. XI, p. 145–154.

NEW HAMPSHIRE.

Wilcox, W. A.: The fisheries of New Hampshire. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. II, p. 103–112.

NEW JERSEY.

Earll, R. Edward: New Jersey and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. VII, p. 379–400.

Seely, Uriah: [Fish and lobsters in Raritan Bay.] Bulletin, 1886 (1887), vol. VI, p. 407.

Smith, Hugh M.: Economic and natural history notes on fishes of the northern coast of New Jersey. Bulletin, 1892 (1894), vol. XII, p. 365–380. *Doc. 230 issued Mar. 8, 1894.* F12–165

NEW YORK.

Cobb, John Nathan: The commercial fisheries of the interior lakes and rivers of New York and Vermont. Report, 1903 (1905), p. 227–245. *Doc. 555 issued Jan. 21, 1905.* F11–11

Mather, Fred: New York and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. VI, p. 341–377.

NORTH CAROLINA.

Coxe, Frank: Opening the Broad and other rivers of North Carolina to shad, bass, etc. Bulletin, 1884 (1884), vol. IV, p. 232. F18–294

Earll, R. Edward: North Carolina and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. XII, p. 475–497.

Milner, J. W.: Summary of fishing records, for shad and alewives kept at Willow Branch fishery, North Carolina, from 1835–1874. Bulletin, 1881 (1882), vol. I, p. 396–401. F12–338

Radcliffe, Lewis: The offshore fishing grounds of North Carolina. 6 p., illus. *Economic Circular 8 issued Feb. 25, 1914.* F14–120

Smith, Hugh McCormick: [Fisheries of North Carolina.] Bulletin, 1891 (1893), vol. XI, p. 282–306.

——— [Fisheries of the Albemarle region, North Carolina, in 1892.] Report, 1892 (1894), p. CLIX–CLX.

——— [Condition of the fisheries of North Carolina.] Report, 1914 (1915), p. 23–25.

OREGON.

Johnston, Edward C.: Survey of the fishing grounds on the coasts of Washington and Oregon in 1915. Appendix VI, Report, 1915 (1917), 20 p., 4 charts (part fold.). *Doc. 835 issued Nov. 1916.* F16–332

Rathbun, Richard: [Investigations of the fisheries of Oregon by the steamer *Albatross* from July 1, 1888, to July 1, 1892.] Bulletin, 1892 (1894), vol. XII, p. 166–173.

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coasts of Washington and Oregon in 1914. Appendix VII, Report, 1914 (1915), 30 p., pl., fold. table, [2] fold. charts. *Doc. 817 issued June 8, 1915.* F15–86

Smith, Hugh McCormick: [Investigations of the lake fisheries of Oregon in 1897.] Report, 1898 (1899), p. CXXXII–CXXXVII.

Tanner, Zera Luther: [Investigations of the fisheries of Oregon in 1888, by the U. S. Fish commission steamer *Albatross*.] Bulletin, 1888 (1890), vol. VIII, p. 53–70.

——— [Investigations of the fisheries of Oregon by the U. S. Fish commission steamer *Albatross* from July 1, 1889, to June 30, 1891.] Report, 1889–1891 (1893), p. 212–218, 271–275.

U. S. Bureau of Fisheries: Explorations of the fishing grounds of Alaska, Washington Territory, and Oregon, during 1888, by the U. S. Fish commission steamer *Albatross*, Lieut. Commander Z. L. Tanner, U. S. N., commanding. Bulletin, 1888 (1890), vol. VIII, p. 1–95 incl. tables, XII pl. (partly fold.). *Doc. 135 issued 1889.* F11–292

PENNSYLVANIA.

Earll, R. Edward: Pennsylvania and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. VIII, p. 401–405.

RHODE ISLAND.

Clark, A. Howard: The fisheries of Rhode Island. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. IV, p. 281–310.

Rhode Island, General Assembly: [Report of committee of Rhode Island legislature, made at Newport, June 15, 1870, on the fisheries of Rhode Island.] Report, 1871 and 1872 (1873), p. 104–111.

——— A petition to the Fish commission of the United States, signed by the fishermen of Block Island, June 12, 1877. Report, 1878 (1880), p. 35–39. F16–152

SOUTH CAROLINA.

Earll, R. Edward: The fisheries of South Carolina and Georgia. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. XIII, p. 499–518.

Smith, Hugh McCormick: [Fisheries of South Carolina.] Bulletin, 1891 (1893), vol. XI, p. 307–318.

TEXAS.

Collins, Joseph William, and Hugh McCormick Smith: [The fisheries of Texas.] Bulletin, 1891 (1893), vol. XI, p. 172–184.

Stevenson, Charles Hugh: Report on the coast fisheries of Texas. Report, 1889–1891 (1893), p. 373–420, frontis pls. 12–27. *Doc. 218 issued Nov. 4, 1893.* F16–83

UTAH.

Smith, Hugh McCormick: [Fisheries of Utah in 1895.] Report, 1896 (1898), p. 127.

VERMONT.

Cobb, John Nathan: The commercial fisheries of the interior lakes and rivers of New York and Vermont in 1902. Report, 1903 (1905), p. 227–246. *Doc. 555 issued Jan. 21, 1905.* F11–11

VIRGINIA.

Downman, R. H.: Shad, herring, etc., excluded from the Rappahannock River by dams. Bulletin, 1883 (1883), vol. III, p. 392. F18–149

McDonald, Marshall: Virginia and its fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. XI, p. 449–473.

Milner, James W.: Report of the Triana trip. Report, 1873–74 and 1874–75 (1876), p. 351–362. F16–19

Wilkins, J.: The fisheries of the Virginia coast. Bulletin, 1893 (1894), vol. XIII, p. 355–356.

WASHINGTON.

Johnston, Edward C.: Survey of the fishing grounds on the coasts of Washington and Oregon in 1915. Appendix VI, Report, 1915 (1917), 20 p., incl. tables, 1 chart. *Doc. 835 issued Nov. 9, 1916.* F16–332

Rathbun, Richard: [Investigations of the fishing grounds of Washington by the U. S. Fish commission steamer *Albatross* from July 1, 1888, to July 1, 1892.] Bulletin, 1892 (1894), vol. XII, p. 159–166.

——— A review of the fisheries in the contiguous waters of the State of Washington and British Columbia. Report, 1899 (1900), p. 251–350. *Doc. 423 issued Nov. 15, 1899.* F11–108

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coast of Washington and Oregon in 1914. Appendix VII, Report, 1914 (1915), 30 p., pl., fold. table, [2] 1 fold. charts. *Doc. 817 issued June 8, 1915.* F15–86

Tanner, Zera Luther: [Report on the investigations of the fisheries of Washington by the U. S. Fish commission steamer *Albatross* from July 1, 1889, to June 30, 1891.] Report, 1889–1891 (1893), p. 210–218, 271–275.

U. S. Bureau of Fisheries: Explorations of the fishing grounds of Alaska, Washington Territory, and Oregon, during 1888, by the U. S. Fish commission steamer *Albatross*, Lieut. Z. L. Tanner, U. S. N., commanding. Bulletin, 1888 (1890), vol. VIII, p. 1–95 incl. tables, XII pl. (partly fold.). *Doc. 135 issued 1889.* F11–292

ATLANTIC STATES.

McDonald, Marshall: The river fisheries of the Atlantic States. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. XII, p. 611–728.

Smith, Hugh M.: Report on the fisheries of the South Atlantic States. Bulletin, 1891 (1893), vol. XI, p. 269–356 incl. tables, pl. XLIII–LXXIV. *Doc. 212 issued June 12, 1893.* F12–406

True, Frederick W.: The pound-net fisheries of the Atlantic States. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, p. 595–609.

U. S. Commissioner of Fisheries: [The fisheries of the Middle Atlantic States in 1892.] Report, 1892 (1894), p. XII–XIII.

GULF STATES.

Collins, Joseph William, and Hugh M. Smith: Report on the fisheries of the Gulf States. Bulletin, 1891 (1893), vol. XI, p. 91–184. *Doc. 206 issued Nov. 26, 1892.* F12–124

Smith, Hugh M.: [Investigations of the fisheries of the Gulf States.] Report, 1889–1891 (1893), p. 179–180.

NEW ENGLAND STATES.

Baird, Spencer Fullerton: [Notices in regard to the abundance of fish of the New England coast in former times.] Report, 1871 and 1872 (1873), p. 149–172.

——— Supplementary testimony and information relative to the condition of the fisheries of the south side of New England taken in 1872. Notes taken by the commissioner. Report of Vinal N. Edwards. Additional notes taken by the commissioner. Report, 1871 and 1872 (1873), p. 182–195. F16–60

——— Natural history of some of the more important food-fishes of the south shore of New England. Report, 1871 and 1872 (1873), p. 228–252. F15–100

Clark, A. Howard: Historical references to the fisheries of New England. *In* Appendix to the Fisheries and fishery industries of the United States. 1887. Sec. II, p. 675–737.

Collins, Joseph William, and Hugh M. Smith: Report on the fisheries of the New England States. Bulletin, 1890 (1892), vol. X, p. 73–176 incl. tables. *Doc. 193 issued July 23, 1892.* F12–132

Martin, Stephen J.: Notes on New England fisheries. Bulletin, 1881 (1882), vol. I, p. 133. F18–31

——— Notes on New England food-fishes. Bulletin, 1881 (1882), vol. I, p. 202. F18–36

Rhode Island, General Assembly: [Report on committee of Rhode Island legislature, made at Newport, June 15, 1870, on the condition of the sea fisheries of the south coast of New England in 1871 and 1872.] Report, 1871 and 1872 (1873), p. 104–111.

U. S. Bureau of Fisheries: Testimony in regard to the present condition of the fisheries, taken in 1871. Report, 1871 and 1872 (1873), p. 7–72, illus. F16–50

——— Special arguments in regard to regulating the sea fisheries by law. Arguments of Samuel Powel, esq., delivered in the Rhode Island legislature. Argument of J. M. K. Southwick. The food-fishes of the New England coast. By George H. Palmer. Report, 1871 and 1872 (1873), p. 73–103. F16–51

——— [Miscellaneous correspondence and communications on the subject of the sea fisheries of the south coast of New England.] Report, 1871 and 1872 (1873), p. 135–138. F16–57

Wilcox, W. A.: New England fisheries for 1885 and 1886. Bulletin, 1885 (1885), vol. V, p. 162–174, 197–199, 442–445; 1886 (1887), vol. VI, p. 33–39, 200–202, 210–212, 241–245, 273–275, 328–331, 332–336, 418–420, 423–424. F18–529

PACIFIC STATES.

Baird, S. F.: [Proposed extension of fishery investigations by the *Albatross* to the Pacific.] Report, 1886 (1889), p. XV–XVI.

Johnston, Edward C.: Survey of the fishing grounds on the coasts of Washington and Oregon in 1915. Appendix VI, Report, 1915 (1917), 20 p., 4 charts (part fold.). *Doc. 835 issued Nov. 9, 1916.* F16–332

Jordan, David Starr: The fisheries of the Pacific coast. (E. Alaska and its fishery interests, by Tarleton H. Bean.) *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. XVI, p. 589–630.

Moser, Jefferson F.: [Fishery investigations of the steamer *Albatross* on the Pacific coast during 1897.] Report, 1897 (1898), p. CXLVII–CLII.

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coast of Washington and Oregon in 1914. Appendix VII, Report, 1914 (1915), 30 p., pl., fold. table, 2 fold. chart. *Doc. 817 issued June 8, 1915.* F15–86

Smith, Hugh McCormick: Notes on a reconnaissance of the fisheries of the Pacific coast of the United States in 1894. Bulletin, 1894 (1895), vol. XIV, p. 223–288. *Doc. 293 issued May 21, 1895.* F11–351

——— [Shad, striped bass, catfish, and carp on the Pacific coast.] Report, 1896 (1898), p. 140–141.

Townsend, Charles H.: [Fisheries of the Pacific coast.] Report, 1885 (1887), p. LXIX–LXX.

U. S. Commissioner of Fisheries: [The Pacific coast fisheries for 1912 and 1913.] Report, 1913 (1914), p. 62–64.

——— [Pacific coast fisheries.] Report, 1912 (1913), p. 37.

Wilcox, William A.: The fisheries of the Pacific coast. Report, 1893 (1895), p. 139–304. *Doc. 299 issued Mar. 18, 1896.* F20–151

——— Notes on the fisheries of the Pacific coast in 1895. Report, 1896 (1898), p. 575–659. *Doc. 362 issued Mar. 28, 1898.* F11–185

——— Notes on the fisheries of the Pacific coast in 1899. Report, 1901 (1902), p. 501–574, pl. 28–29. *Doc. 505 issued Oct. 24, 1902.* F11–28

——— The commercial fisheries of the Pacific Coast States for 1904. Report and special papers, 1905 (1907), 74 p. *Doc. 612 issued Feb. 25, 1907.* 7–35100

INTERIOR WATERS.

Rathbun, Richard: [Investigations of interior water fisheries.] Report, 1896 (1898), p. 113–116, 119–128.

LAKE ST. CLAIR.

Smith, Hugh McCormick: [The fisheries of Lake St. Clair and of the St. Clair and Detroit rivers.] Report, 1887 (1891), p. 227–232; 1892 (1894), p. CXLVII; 1895 (1896), p. 100.

U. S. Bureau of Fisheries: [The fisheries of Lake St. Clair and of the St. Clair and Detroit rivers in 1899.] Report, 1901 (1902), p. 627–629.

——— [The fisheries of Lake St. Clair and of the St. Clair and Detroit rivers in 1903.] Report, 1904 (1905), p. 700–703.

LAKE WASHINGTON.

Rathbun, Richard: [The fisheries of Lakes Washington and Pend d'Oreille in 1896.] Report, 1896 (1898), p. 115–116.

Townsend, Charles Haskins: [The fisheries of Lake-of-the-Woods in 1899.] Report, 1901 (1902), p. 151–152.

GREAT LAKES.

Baird, Spencer Fullerton: [Investigations of the fisheries of Great Lakes.] Report, 1872 and 1873 (1874), p. XIV–XVI.

——— [Investigations of the fisheries of the Great Lakes.] Report, 1885 (1887,) p. LX–LXII.

Bissell, John H.: The Canadian and American fisheries of the Great Lakes. Bulletin, 1887 (1889), vol. VII, p. 7–10 incl. tables. F18–635

Kumlien, Ludwig: The fisheries of the Great Lakes. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 1, pt. XII, p. 755–769.

Milner, James W.: Report on fisheries of the Great Lakes; the result of inquiries prosecuted in 1871 and 1872. Report, 1872–73 (1874), p. 178, pl. XXVII. F15–91

Nelson, Edward William: Fisheries of Chicago and vicinity. Report, 1875–76 (1878), p. 783–800, illus. F16–69

Smiley, Charles Wesley: Changes in the fisheries of the Great Lakes during the decade 1870–1880. Bulletin, 1881 (1882), vol. I, p. 252–258. F18–45

Smith, Hugh McCormick: Report on the fisheries of the Great Lakes. Report, 1892 (1894), p. 361–462. *Doc. 287 issued Dec. 20, 1894.* F14–54

Smith, Hugh McCormick, and Merwin-Marie Snell: A review of the fisheries of the Great Lakes in 1885. With introduction and description of fishing vessels and boats, by J. W. Collins. Report, 1887 (1891), p. 3–334. *Doc. 140 issued Mar. 2, 1891.* F11–330

——— Report on the fisheries of Lake Ontario. Bulletin, 1890 (1892), vol. X, p. 177–215, pl. XXI–L. *Doc. 194 issued July 16, 1892.* F12–129

——— [The fisheries of the Great Lakes in 1890.] Report, 1892 (1894), p. CXXXVI–CLIV.

True, Frederick William: The fisheries of the Great Lakes (elaborated from notes gathered by Mr. Ludwig Kumlien.) *In* The fisheries and fishery industries of the United States. 1887. Sec. II, p. XVII, p. 631–673.

COLUMBIA RIVER.

Rathbun, Richard: [Fishery investigation of the Columbia River basin.] Report, 1894 (1896), p. 100–102; 1895 (1896), p. 86–88; 1896 (1898), p. 113–114.

INDIAN RIVER.

Rathbun, Richard: [Fishery investigations in Indian River.] Report, 1896 (1897), p. 112–113.

MISSISSIPPI RIVER.

U. S. Bureau of Fisheries: [Fisheries of the Mississippi River and tributaries.] Report, 1901 (1902), p. 157–160.

POTOMAC RIVER.

Milner, James W.: Report of the Triana trip. Report, 1873–74 and 1874–75 (1876), p. 351–362. F16–19

Smith, Hugh McCormick: [Fisheries of the Potomac River and its tributaries.] Report, 1889–1891 (1893), p. 180–183.

Wood, William Maxwell: Report on the trap-nets fished in the spring of 1883 in the Potomac River and Chesapeake Bay. Bulletin, 1883 (1883), vol. III, p. 278–280 incl. tables. F18–135

GULF OF MEXICO.

Collins, Joseph William: Report on the discovery and investigation of fishing grounds made by the Fish commission steamer *Albatross* during a cruise along the Atlantic coast and in the Gulf of Mexico, with notes on the Gulf fisheries. Report, 1885 (1887), p. 217–311. *Doc. 119 issued Nov. 3, 1887.* F11–298

Phillips, Barnet: Notes on a trip in the Gulf of Mexico. Bulletin, 1884 (1884), vol. IV, p. 144. F18–254

Rathbun, Richard: [The fisheries of the Gulf of Mexico.] Report, 1888–89 (1892), p. LVI–LIX.

Sellars, L. H.: Abundance of fish in the Gulf of Mexico. Bulletin, 1885 (1885), vol. V, p. 304. F18–449

Stearns, Silas: Fluctuations in the fisheries of the Gulf of Mexico and the proposed investigation of them. Bulletin, 1883 (1883), vol. III, p. 467–468. F18–191

——— Examination of the fisheries in the Gulf of Mexico. Bulletin, 1885 (1885), vol. V, p. 285–287. F18–441

Stearns, Silas, and David Starr Jordan: Fisheries of the Gulf of Mexico. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. XV, p. 533–587.

Tanner, Zera Luther: Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending December 31, 1885. Report, 1885 (1887), 89 p. *Doc. 118 issued Nov. 3, 1887.* F11–299

Wood, M. L.: The fisheries of the Gulf of Mexico. Bulletin, 1882 (1883), vol. II, p. 19–20. F18–68

GULF OF ST. LAWRENCE.

Low, D. W.: [Itinerary of a mackerel voyage to the Gulf of St. Lawrence.] Report, 1881 (1884), p. 195–197.

CHESAPEAKE BAY.

Collins, Joseph William: [Investigation of the fisheries of Chesapeake Bay.] Report, 1887 (1891), p. 566–581.

Rathbun, Richard: [Fishery investigations in Chesapeake Bay.] Report, 1892 (1894), p. CVII.

Smith, Hugh McCormick: [The fisheries of lower Chesapeake Bay.] Report, 1889–1891 (1893), p. 184–194.

Tanner, Zera Luther: Report of an exploring trip of the steamer *Fish Hawk*, in Chesapeake Bay in the early spring of 1882. Bulletin, 1882 (1883), vol. II, p. 133–135. F12–351

U. S. Bureau of Fisheries: [Fisheries of Chesapeake Bay and its tributaries.] Report, 1915 (1917), p. 79.

Wood, William Maxwell: Report on the trap-nets fished in the spring of 1883 in the Potomac River and Chesapeake Bay. Bulletin, 1883 (1883), vol. III, p. 278–280 incl. tables. F18–135

——— Report of a trip made by the *Fish Hawk* to the lower part of Chesapeake Bay, to ascertain the character of the fisheries for shad, herring, etc., in the spring of 1884. Bulletin, 1884 (1884), vol. IV, p. 199–200. F18–281

PUGET SOUND.

Hammond, J. P.: Fish in Puget Sound. Bulletin, 1886 (1887), vol. VI, p. 195–196. F18–572

Swan, James G.: Notes on the fisheries and the fishery industries of Puget Sound. Bulletin, 1893 (1894), vol. XIII, p. 371–380. *Doc. 274 issued June 16, 1894.* F12–183

CANADA.

GENERAL.

Bissell, John H.: The Canadian and American fisheries of the Great Lakes. Bulletin, 1887 (1889), vol. VII, p. 7–10, incl. tables.

The fisheries of Canada in 1884. Bulletin, 1886 (1887), vol. VI, p. 51–56. F18–531

Joncas, Louis Zepherin: The Canadian fisheries. Bulletin, 1884 (1884), vol. IV, p. 457–463. F13–75

Rathbun, Richard: [Fisheries in waters contiguous to Canada and the United States.] Report, 1893 (1895), p. 20–22; 1894 (1896), p. 87–89.

Statements concerning the fisheries of several different countries. (Nova Scotia, p. 1184–1185; Quebec, 1185–1186.) Comp. from the Consular report for 1882 and 1883. Report, 1883 (1885), p. 1183–1199. F17–43

BRITISH COLUMBIA.

Rathbun, Richard: A review of the fisheries in the contiguous waters of the State of Washington and British Columbia. Report, 1899 (1900), p. 251–350, pls. *Doc. 423 issued Nov. 15, 1899.* F11–108

LABRADOR.

Hayward, Joseph H.: Catch of fish in Newfoundland and Labrador in 1881. Bulletin, 1882 (1883), vol. II, p. 286. F18–103

Stearns, Winfrid Alden: The Labrador fisheries. Bulletin, 1885 (1885), vol. V, p. 6–27. F18–366

NEWFOUNDLAND.

Anderssen, Joakim: [Fisheries of Newfoundland.] Report, 1878 (1880), p. 64–67.

Collins, Joseph William: Fishing on an edge of the Grand Banks. Bulletin, 1885 (1885), vol. V, p. 256. F18–426

——— [The Newfoundland cod fishery.] Report, 1887 (1891), p. 529–546.

Donnelly, W. J. S.: Exports of fish and fishery products from Newfoundland during 1884. Bulletin, 1886 (1887), vol. VI, p. 14–16. F18–527

Harvey, Moses: Fishing and consumption of fish in Newfoundland. Bulletin, 1882 (1883), vol. II, p. 102. F18–81

Hayward, Joseph H.: Catch of fish in Newfoundland and Labrador in 1881. Bulletin, 1882 (1883), vol. II, p. 286. F18–103

U. S. Bureau of Fisheries: [Newfoundland fisheries.] Report, 1906 (1908), p. 24–25.

NOVA SCOTIA.

Anderssen, Joakim: [Brief account of the fisheries of Nova Scotia.] Report, 1878 (1880), p. 64–67.

WEST INDIES.

BAHAMA ISLANDS.

Nye, Willard: Fish and fishing at Abaco Island. Bulletin, 1886 (1887), vol. VI, p. 125–126.

PORTO RICO.

U. S. Bureau of Fisheries: Investigations of the aquatic resources and fisheries of Porto Rico by the United States fish commission steamer *Fish Hawk* in 1899. (*Contents.*—General report, by B. W. Evermann. The fisheries and fish trade of Porto Rico, by W. A. Wilcox. The fishes of Porto Rico, by B. W. Evermann and M. C. Marsh.) Bulletin, 1900 (1902), vol. XX, in 2 pts., illus., maps, pls. *Doc. 451 issued Dec. 15, 1900.* 5–4161

Wilcox, William A.: Notes on the foreign fishery trade and local fisheries of Porto Rico. Report, 1899 (1900), 34 p., incl. tables, illus., 6 pl. *Doc. 418 issued Oct. 4, 1899.* F11–104

——— The fisheries and fish trade of Porto Rico in 1902. Report, 1902 (1904), p. 367–395, incl. tables. *Doc. 539 issued Sept. 19, 1903.* F11–5

SOUTH AMERICA.

GENERAL.

Krause, Hans Gunner: The fisheries of the west coast of South America. Report, 1879 (1882), pl. 515–522. F17–8

BRITISH GUIANA.

Quelch, J. J.: Fish and fishing in British Guiana. Bulletin, 1893 (1894), vol. XIII, p. 237–240. *Doc. 260 issued June 9, 1894.* F12–183

PERU.

Coker, Robert Erwin: The fisheries and guano industry of Peru. Bulletin, 1908 (1910), vol. XXVIII, p. 333–365, pl. XII–XVII. *Doc. 663 issued February, 1910.* 10–35150

EUROPE.

GENERAL.

Costa, Achille: European authorities on the subject of regulating the fisheries by law. On the fisheries of the Gulf of Naples, by Achille Costa. On the possibility of exhausting the sea fisheries, by James G. Bertram. Extract from the London Field, 1871. Extracts from the report of the Commissioners appointed to inquire into the sea fisheries of the United Kingdom; presented to both houses of Parliament by command of Her Majesty. London, 1861. Report, 1871 and 1872 (1873), p. 139–148. F16–58

Foreign fisheries in 1885. Bulletin, 1886 (1887), vol. VI, p. 81–82 incl. tables. F18–541

AUSTRIA.

Peyrer, Karl: Fisheries and fishery laws in Austria and of the world in general. Report, 1873–74 and 1874–75 (1876), p. 570–679. F16–31

[**Sea** fisheries of Austria-Hungary from 1877 to 1883.] Report, 1883 (1885), p. 1197–1199.

BELGIUM.

Collins, J. W.: [Beam-trawl fishery of Belgium.] Bulletin, 1887 (1889), vol. VII, p. 390–393.

DENMARK.

Dambeck, Carl: [Fisheries of Denmark.] Report, 1873–74 and 1874–75 (1876), p. 22.

——— Geographical distribution of the Gadidæ or cod family, in its relation to fisheries and commerce. Report, 1877 (1879), p. 531–557. F16–108

The **fishing** villages, Snekkersteen and Skotterup, and the collection of fishing implements exhibited by them at Elsinore, Denmark, during the summer of 1872. Report, 1873–74 and 1874–75 (1876), p. 173–181.

Oterendorp, C. G. von: A visit to the chief fishing places of Jutland. Bulletin, 1887 (1889), vol. VII, p. 101–104. F18–657

FRANCE.

Collins, J. W.: [Beam-trawl fishery of France.] Bulletin, 1887 (1889), vol. VII, p. 388–390.

France, Minister of Marine and the Colonies: Sea fisheries of France and Algeria. Bulletin, 1887 (1889), vol. VII, p. 51–55. F18–646

Peixotto, Benjamin F.: The sea fisheries of France and Algiers. Bulletin, 1884 (1884), vol. IV, p. 417–419. F13–117

Statements concerning the fisheries of several countries. (France: p. 1189.) Comp. from Consular report for 1882 and 1883. Report, 1883 (1885), p. 1183–1199. F17–43

GERMANY.

Collins, J. W.: [Beam-trawl fishery of Germany.] Bulletin, 1887 (1889), vol. VII, p. 398–399.

Dantziger: The first five years of the Emden joint-stock herring-fishery association. Report, 1877 (1879), p. 751–776. F16–115

Hubner, A.: Notes upon the increase and decrease of fish. Bulletin, 1886 (1887), vol. VI, p. 187–190. F18–569

Keller, H.: Freedom of migration for fish in Germany. Bulletin, 1886 (1887), vol. VI, p. 113–116. F18–553

Möbius, Karl August: Can we do anything to decrease, preserve, or increase the number of our useful marine animals? Bulletin, 1883 (1883), vol. III, p. 393–400. F12–421

Peyrer, Karl: [German fisheries.] Report, 1873–74 and 1874–75 (1876), p. 587–588.

GREAT BRITAIN.

Alexander, Alvin B.; H. F. Moore; and W. C. Kendall: Otter-trawl fishery. (Demersal fisheries of England, Wales, and Scotland: p. 57–90.) Appendix VI, Report, 1914 (1915), 97 p. *Doc. 816 issued Apr. 17, 1915.* F15–40

Anderson, John: Notes upon the Scotch fish and fisheries. Bulletin, 1885 (1885), vol. V, p. 217–221. F18–411

Annaniassen, Abraham: Klip fish at the Shetland Islands. Bulletin, 1885 (1885), vol. V, p. 316–319. F18–462

Benecke, Berthold: [Scotch fisheries.] Report, 1884 (1886) p. 7, 1188.

Bertram, James G.: [On the possibility of exhausting the sea fisheries. Extracted from the "Harvest of the Sea," a contribution to the natural and economic history of the British food-fishes.] Report, 1871 and 1872 (1873), p. 141–144.

Carr, T. F. Robertson: Notes on the Scotch fisheries. Bulletin, 1884 (1884), vol. IV, p. 64. F18–223

Collins, J. W.: The beam-trawl fishery of Great Britain, with notes on beam-trawling in other European countries. Bulletin, 1887 (1889), vol. VII, p. 289–407, illus., XXIII pl. (partly fold.). F11–329

Duff, R. W.: On the fisheries of Great Britain and the fisheries exhibition of 1883. Report, 1883 (1885), p. 317–324. F17–27

Great Britain, Commissioners Appointed to Inquire into the Sea-Fisheries of the United Kingdom: [Extracts from report of Commissioners, James T. Caird, T. H. Huxley, and G. S. Lefevre, appointed to inquire into the sea-fisheries of the United Kingdom; presented to both houses of Parliament by command of Her Majesty. London, 1861.] Report, 1871 and 1872 (1873), p. 145–148.

Harding, Charles William: Inquiries concerning the propagation of American smelt and shad, and notes on the fisheries of the Wash in England. Bulletin, 1881 (1882), vol. I, p. 428–429. F18–59

Peyrer, Karl: [Fisheries of Great Britain.] Report, 1873–74 and 1874–75 (1876), p. 585–586.

The **Scotch** cod and ling fisheries. Bulletin, 1884 (1884), vol. IV, p. 371–372. F18–334

Scotland, Fishery board: Extracts from the first annual report of the Fishery board of Scotland for the year ending December 31, 1882. (Contents—A. Scientific investigations proposed by the Fishery board of Scotland as necessary for the improvement of the fisheries. B. The effect of fixed engines on the salmon fisheries: a prize essay on salmon legislation in Scotland, by J. M. Leith. C. The herring, cod, and ling fisheries of 1882.) Report, 1882 (1884), p. 229–236. F16–318

Southwell, Thomas: Notes on the English herring fishery of 1882. Bulletin, 1883 (1883), vol. III, p. 465–466. F12–390

Statements concerning the fisheries of several different countries. (Comp. from the Consular report for 1882 and 1883.) Report, 1883 (1885), p. 1183–1199. F17–43

GREECE.

Smidth, J. K.: Historical observations on the condition of the fisheries among the ancient Greeks and Romans, and on their mode of salting and pickling fish. Report, 1873–74 and 1874–75 (1876), p. 3–20. F16–2

ICELAND.

Annaniassen, A.: Extracts from the report of A. Annaniassen on his voyage to Iceland. Manufacture of klip-fish. Report, 1884 (1886), p. 309–313. F17–129

Collins, Joseph William: The Icelandic halibut fishery. An account of the voyage of three Gloucester schooners to the fishing grounds near the north coast of Iceland. Report, 1884 (1886), p. 289–300. F17–128

Finn, W.: The Iceland herring fisheries. Report, 1879 (1882), p. 493–496. F17–5

The **freshwater** fishes of Iceland. Report, 1884 (1886), p. 323–332. F20–121

Garde, Aug.: The fisheries of Iceland. Report, 1884 (1886), p. 301–308. F20–124

The **Iceland** fresh-water fisheries. Bulletin, 1886 (1887), vol. VI, 161–176. F18–566

Thorarinsson, Bened S.: Notes on the hatcheries and fresh-water fisheries of Iceland. Bulletin, 1887 (1889), vol. VII, p. 120–126. F18–661

Thorsteinson, Árni Bjarnason: Extracts from a review of A. Annaniassen's voyage to Iceland. Report, 1884 (1886), p. 315–322. F17–130

Trolle, C.: The Iceland fisheries. Report, 1880 (1883), p. 77–78. F16–301

——— The Iceland cod fisheries in 1883. Report, 1883 (1885), p. 371–383. F17–31

ITALY.

Costs, Achille: [On the fisheries of the Gulf of Naples.] Report, 1871 and 1872 (1873), p. 139–148.

Rossati, Guido: Economic conditions of the fisheries in Italy. Bulletin, 1908 (1910), vol. XXVIII, p. 323–332. *Doc. 662 issued February, 1910.* 10–35158

Smidth, J. K.: Historical observations on the condition of the fisheries among the ancient Greeks and Romans, and on their mode of salting and pickling fish. Report, 1873–74 and 1874–75 (1876), p. 3–20. F16–2

Worthington, John: Falling off in the fisheries of Malta. Bulletin, 1885 (1885), vol. V, p. 400. F18–483

——— The fisheries of Malta. Bulletin, 1885 (1885), vol. V, p. 457–462. F18–509

NETHERLANDS.

Collins, J. W.: [Beam-trawl fishery of Holland.] Bulletin, 1887 (1889), vol. VII, p. 393–398.

[Fisheries of Amsterdam.] Report, 1883 (1885), p. 1192–1194.

NORWAY.

Boeck, Axel, i. e. Jones, Axel, and A. Fedderson: The Norwegian herring-fisheries. Report, 1873–74 and 1874–75 (1876), p. 97–122. F16–7

Central administration of Norwegian fisheries needed. Report, 1884 (1886), p. 353–361. F20–114

Collins, Joseph William: Gill-nets in cod fishery [a description of the Norwegian cod-nets, with directions for their use, and a history of their introduction into the United States]. Bulletin, 1881 (1881), vol. I, 17 p., XIII pl. *Doc. 37 issued June 30, 1881.* F12–219

——— Gill-nets in the cod-fishery: A description of Norwegian cod-nets, etc., and history of their use in the United States. Report, 1884 (1886), p. 265–288, XII pl. F17–127

Dambeck, Carl: [Fisheries of Norway.] Report, 1873–74 and 1874–75 (1876), p. 21.

Friele, M.: An account of the fisheries of Norway in 1877. Report, 1877 (1879), p. 707–739. F16–113

Heincke, Friedrich, i. e. Johann Friedrich: The sea fisheries of Norway. Bulletin, 1886 (1887), vol. VI, p. 265–272. F18–589

Juel, Niels: Statistics of the Loffoden fisheries. Report, 1878 (1880), p. 245–254; 1881 (1884), p. 533–610. F16–160

Kiaer, Anders Nicolai: Notes on the Norwegian fisheries for 1885. Report, 1886 (1889), p. 1055–1064 incl. tables. F17–150

New contributions to the herring question. The dispute between Axel Boeck and Ossian Sars regarding the Norwegian summer-herring. Sars's recent observations and his new theory on the migrations of the herrings. Report, 1873–74 and 1874–75 (1876), p. 195–211. F16–12

Norges Fiskeristyrelse: On the fisheries of Norway. (Translation of a printed letter addressed to the United States Fish commissioner by the authorities of the Norwegian commission, in response to an application for documents relative to the fisheries of Norway and Sweden.) Report, 1873–74 and 1874–75 (1876), p. 25–30. F16–4

The **Norwegian** fisheries in 1883, with statistics of previous years. Report, 1883 (1885), p. 359–369. F20–165

The **Norwegian** fisheries in 1885. Bulletin, 1886 (1887), vol. VI, p. 82–83. F18–541

Sars, George Ossian: Reports made to the Department of the interior of investigations of the salt-water fisheries of Norway during the years 1874–1877. Report, 1877 (1879), p. 663–705. F16–112

——— Report of practical and scientific investigations of the cod-fisheries near the Loffoden Islands, made during the years 1870–1873. Report, 1877 (1879), p. 612 661. F16–111

——— Report of the practical and scientific investigations of the cod-fisheries near the Loffoden Islands, made during the years 1864–1869. Report, 1877 (1879), p. 565–611. F16–110.

Society for promoting the Norwegian fisheries. By John Amelin and sixteen others. Report, 1878 (1880), p. 241–243. F16–159

Ström, Boye: Extracts from Norwegian official statistics of fisheries for the year 1880. Report, 1881 (1884), p. 611–617. F16–333

——— Statistics of Norwegian fisheries in 1880. Report, 1884 (1886), p. 333–351 incl. tables. F16–333

——— Extracts from the Norwegian fishery statistics for 1884. Report, 1885 (1887), p. 313-323 incl. tables. F16–333

PORTUGAL.

Syle, L. du Pont: Fisheries of Madeira in 1882. Report, 1883 (1885), p. 1196-1197. F17–43

SPAIN.

Collins, J. W.: [Beam trawl fishery of Spain.] Bulletin, 1887 (1889), vol. VII, p. 399–400.

Reed, Dwight T.: [Fisheries of Spain in 1879.] Report, 1883 (1885), p. 1195-1199.

SWEDEN.

Dambeck, Carl: [Fisheries of Sweden.] Report, 1873–74 and 1874–75 (1876), p 21–24.

Ljungman, Axel Vilhelm: The salt-water fisheries of Bohuslan and the scientific investigations of the salt-water fisheries. Report, 1878 (1880), p. 143–220. F16-157

——— The great Bohuslan herring-fisheries. Report, 1878 (1880), p. 221–239. F16-158

——— Contributions toward solving the question of the secular periodicity of the great herring fisheries. Report, 1879 (1882), p. 497–503. F17-6

——— The Bohuslan sea fisheries and their future. Report, 1880 (1883), p. 89–98. F16–290

——— What should be done by the government with regard to the great Bohuslan herring fisheries. A memorial addressed to the Council of state and the head of the Royal civil department of Sweden. Report, 1880 (1883), p. 99–126. F16–291

——— Sweden at the great International fishery exposition at London, 1883. Bulletin, 1883 (1883), vol. III, p. 231–239. F18–128

——— The great herring fisheries considered from an economical point of view. Report, 1883 (1885), p. 341–357. F17–30

——— Special results of the investigations relating to the herring and herring fisheries on the west coast of Sweden made during the years 1873–1883. Report, 1883 (1885), p. 729–745. F17–34

——— The future of the herring fisheries on the coast of Bohuslan. Report, 1884 (1886), p. 399–409. F17–132

Lundberg, Rudolph: The fisheries of Sweden. Report, 1884 (1886), p. 363–398. F17–131

Malmgren, Anders Johan: The injurious effects of rafting on the lake and river fisheries of Sweden. Bulletin, 1885 (1885), vol. V, p. 264–266. F18–430

Widegren, Hjalmar: On the herring and its preparation as an article of trade. Report, 1873–74 and 1874–75 (1876), p. 183–193. F16–11

——— Short introduction to the proper care and management of the Baltic fishery. Report, 1878 (1880), p. 117–141. F16–156

Yhlen, Gerhard von: Report of the sea-fisheries of the Län of Göteborg and Bohus in the year 1877. Report, 1877 (1879), p. 741–750. F16–114

ASIA.

CHINA.

Yen, Wei-Ching W.: The fisheries of China. Bulletin, 1908 (1910), vol. XXVIII, p. 367–373. *Doc. 664 issued Feb., 1910.* 10–35156

INDIA.

Day, Francis: The fisheries of India. Report, 1883 (1885), p. 383–413. F17–32

Mattson, H.: [Fisheries of British India in 1882.] Report, 1883 (1885), p. 1188.

JAPAN.

Baldwin, Charles H.: Notes on the fish and fisheries of Japan. Bulletin, 1884 (1884), vol. IV, p. 352. F18–330

Ito, K.: [Fisheries of northern Japan.] Bulletin, 1893 (1894), vol. XIII, p. 435–438.

——— Fishery industries of the island of Hokkaido, Japan. Bulletin, 1886 (1887), vol. VI, p. 342–345. incl. tables. F18–607

Japan. Bureau of Agriculture: The fisheries of Japan. Bulletin, 1893 (1894), vol. XIII, p. 419–438. *Doc. 277 issued Nov. 15, 1894.* F12–183

Kitahara, T.: The fisheries of Japan considered from a geographical standpoint. Bulletin, 1908 (1910), vol. XXVIII, p. 375–379. *Doc. 665 issued Feb., 1910.* 10–35155

Mitsukuri, Kakichi: The cultivation of marine and fresh-water animals in Japan. Bulletin, 1904 (1905), vol. XXIV, p. 257–289, illus., XI, pl. *Doc. 573 issued June 17, 1905.* F12–10

Smith, Hugh McCormick: Note regarding the promotion of fishery trade between the United States and Japan. Report, 1904 (1905), p. 239–243. *Doc. 576 issued July 17, 1900.* F10–5

SIBERIA.

Caldwell, John K.: Fishing in the Priamus district of Siberia. Appendix VI, Report, 1916 (1917), 31 p. *Doc. 844 issued June 2, 1917.* F17–239

SYRIA.

[The fisheries of Syria.] Bulletin, 1884 (1884), vol. IV, p. 456.

Robeson, John S.: [Fisheries of Syria in 1882.] Report, 1883 (1885), p. 1199.

AFRICA.

ALGERIA.

France, Minister of Marine and the Colonies: [Sea fisheries of France and Algeria in 1885.] Bulletin, 1887 (1889), vol. VII, p. 51–55.

Peixotto, Benjamin F.: The sea fisheries of France and Algiers. Bulletin, 1884 (1884), vol. IV, p. 417–419. F13–117

CAPE COLONY.

Siler, James W.: [Fisheries of Cape Colony.] Report, 1883 (1885), p. 1188.

OCEANICA.

AUSTRALASIA.

Spencer, O. M.: [The fisheries of Australasia in 1882.] Report, 1883 (1885), p. 1186–1188.

HAWAIIAN ISLANDS.

Alexander, Alvin B.: [Fisheries of the Hawaiian Islands.] Report, 1904 (1905), p. 135–136.

Cobb, John Nathan: The commercial fisheries of the Hawaiian Islands in 1903. Appendix, Report, 1904 (1905), p. 433–512. *Doc. 590 issued Dec. 29, 1905.* F10–12

——— The commercial fisheries of the Hawaiian Islands. Bulletin, 1903 (1905), vol. XXIII, pt. III, p. 717–765, illus., pl. 102–106. *Doc. 577 issued Aug. 5, 1905.* F11–389

Jordan, David Starr, and Barton Warren Evermann: The fishes and fisheries of the Hawaiian Islands. A preliminary report. Commercial fisheries of the Hawaiian Islands, by John N. Cobb. Report, 1901 (1902), p. 353–499, pl. 21–27. *Doc. 504 issued Oct. 23, 1902.* F11–27

NEW ZEALAND.

Hector, James: The fisheries of New Zealand. Bulletin, 1884 (1884), vol. IV, p. 53–55. F18–216

OCEANS.

ARCTIC OCEAN.

Schultz, Alexander: Account of the fisheries and seal-hunting in the White Sea, Arctic Ocean, and the Caspian Sea. Report, 1873–74 and 1874–75 (1876), p. 35–96. F16–6

ATLANTIC OCEAN.

Alexander, Alvin Burton; Henry Frank Moore; and William Converse Kendall: Otter-trawl fishery. (Fishing banks of western North Atlantic; p. 22–24.) Appendix VI, Report, 1914 (1915), 97 p., illus., fold. chart, fold. pl. *Doc. 816 issued Apr. 17, 1915.* F15–40

Smith, Hugh McCormick: [The South Atlantic fisheries.] Report, 1889–891 (1893), p. 177–179.

INDIAN OCEAN.

Endicott, Charles: A good fishing ground in the south Indian Ocean. Bullet 1886 (1887), vol. VI, p. 80. F18–539

PACIFIC OCEAN.

Tanner, Zera Luther: Report on the investigations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1889. Report, 1888–89 (1892), p. 395–512. *Doc. 180 issued June 25, 1892.* F12–222

SEAS.

GENERAL.

Scherzer, Karl von: The cultivation of the sea. Bulletin, 1884 (1884), vol. IV, p. 348–350. F18–328

BALTIC SEA.

Hinkelmann: Injuries to the fisheries in the Baltic by seals. Bulletin, 1887 (1889), vol. VII, p. 81–83. F18–643

Prussia, Kommission zur Wissenschaftlichen Untersuchung der Deutschen Meere in Kiel: Popular extracts from the investigations of the commission for scientific examination of the German seas. [By H. A. Meyer, K. Mobius, G. Karsten, V. Hensen.] Report, 1879 (1882), 33 p. F11–214

Widegren, Hjalmar: Short introduction to the proper care and management of the Baltic fishery. Report, 1878 (1880), p. 117–141. F16–156

BERING SEA.

Tanner, Zera Luther: Report upon the investigations of the U. S. Fish commission steamer *Albatross* from July 1, 1889, to June 30, 1891. Report, 1889–1891 (1893), p. 207–342 incl. tables, pl. *Doc. 216 issued Oct. 26. 1893.* F14–133

CASPIAN SEA.

Schultz, Alexander: Account of the fisheries and seal-hunting in the White Sea, the Arctic Ocean, and the Caspian Sea. Report, 1873–74 and 1874–75 (1876), p. 35–96. F16–6

NORTH SEA.

Alexander, Alvin Burton; Henry Frank Moore; and William Converse Kendall: Otter-trawl fishery. (Fisheries of the North Sea: p. 60–69.) Appendix VI, Report, 1914 (1915), 97 p., illus., fold. charts, fold. pls. *Doc. 816 issued Apr. 17, 1915.* F15–40

Prussia, Kommission zur Wissenschaftlichen Untersuchung der Deutschen Meere in Kiel: Popular extracts from the investigations of the commission for scientific examination of the German seas. [By H. A. Meyer, K. Mobius, G. Karsten.] Report, 1879 (1882), 33 p. F11–214

SOUTH SEA.

Moore, Henry Frank: [The *Albatross* South Sea expedition. (Fisheries: p. 150–151.)] Report, 1900 (1901), p. 137–161.

WHITE SEA.

Alexander, Alvin Burton; Henry Frank Moore; and William Converse Kendall: Otter-trawl fishery. (White Sea fishery: p. 72–74.) Appendix VI, Report, 1914 (1915), 97 p. *Doc. 816 issued Apr. 17, 1915.* F15–40

Schultz, Alexander: Account of the fisheries and seal-hunting in the White Sea, the Arctic Ocean, and the Caspian Sea. Report, 1873–74 and 1874–75 (1876), p. 35–96. F16–6

LAWS AND LEGISLATION.

UNITED STATES.

GENERAL.

Baird, Spencer Fullerton: [Measures suggested to prevent the destruction of spawning fish.] Report, 1871 and 1872 (1873), p. XXXIII–XXXVI.

——— [Legislation. Three-mile limit. Season for fishing. International agreements. Federal control of streams. Fishing restrictions, etc.] Report, 1886 (1889), p. 151–160.

Dennis, Oregon Milton: Some reasons for failure of fish protective legislation, and some suggested remedies. Bulletin, 1908 (1910), vol. XXVII, p. 187–192. *Doc. 650 issued Jan. 1910.* 10–35099

Landmark, Anthon, i. e. Even Anthon Thomas: Is sawdust injurious to the fisheries? Report, 1879 (1882), p. 625–632. F17–10

Lyman, Theodore: Laws of inland waters. Bulletin, 1885 (1885), vol. V, p. 271–272. F18–433

McDonald, Marshall: Report upon the protection which should be given by law to the fisheries of the Atlantic coast. Report, 1884 (1886), p. 225–232. F17–125

Meehan, W. E.: The relations between State fish commissions and commercial fishermen. Bulletin, 1897 (1898), vol. XVII, p. 345–348. *Doc. 392 issued Aug. 8, 1898.* F12–110

Perce, H. Wheeler: National aspects of angling and the protection of game fishes. Bulletin, 1908 (1910), vol. XXVII, p. 193–198. *Doc. 651 issued Jan. 31, 1910.* 10–35136

Snell, Merwin P.: An important fish-way cause. Bulletin, 1883 (1883), vol. III, p. 266–268. F12–396

Southwick, J. M. K.: Our ocean fishes and the effect of the legislation upon the fisheries. Bulletin, 1893 (1894), vol. XIII, p. 39–45. *Doc. 241 issued June 9, 1894.* F12–183

U. S. Commissioner of Fisheries: [Jurisdiction of the United States and the States over fishing grounds.] Report, 1877 (1879), p. 26–29.

——— [Legislation in regard to fisheries.] Report, 1879 (1882), p. XXII.

——— [Increasing the supply of food-fishes by protective measures enforced when necessary by law.] Report, 1882 (1884), p. LV–LVIII.

——— [Fishery legislation in the Fifty-ninth Congress.] Report, 1906 (1907), p. 21–23.

U. S. Congress, House: [Bill to protect the freedom of commercial intercourse.] Bulletin, 1886 (1887), vol. VI, p. 142.

——— An Act for securing statistics of the extent and value of the vessel fisheries of the United States. Bulletin, 1887 (1889), vol. VII, p. 25–27. F18–642

——— [A bill to regulate the fisheries (H. R. 5030).] Report, 1892 (1894), p. CLXXXVI–CLXXXVII.

U. S. Congress, House, Committee on the Judiciary: Fishing in the navigable waters of the United States. Bulletin, 1886 (1887), vol. VI, p. 117–119. F18–555

ALASKA.

Bower, Ward T.: Alaska fisheries and fur industries. (Laws and regulations.) Appendix VII, Report, 1918 (1920), p. 16–20; Appendix IX, Report, 1919 (1921), p. 15–23. F12–388

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries. (Laws and regulations.) Appendix IX, Report, 1914 (1915), p. 10–13; Appendix III, Report, 1915 (1917), p. 11–14; Appendix II, Report, 1916 (1917), p. 12–19; Appendix II, Report, 1917 (1919), p. 11–13. F12–388

Bower, Ward T., and H. C. Fassett: [Legislation: p. 37–53.] *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II, Report, 1913 (1914). F12–388

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (New laws in force in 1907: p. 66–70.) Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued May 16, 1907.* 7–35263

Evermann, Barton Warren: Fishery and fur industries of Alaska in 1912. (Complaints and prosecutions: p. 8–9.) Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12–388

Evermann, Barton Warren, and F. M. Chamberlain: [Complaints and prosecutions: p. 6–7.] *In* Alaska fisheries and fur industries in 1911, by B. W. Evermann. Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Laws and violations: p. 30–33.) Report and special papers, 1907 (1909), 77 p. *Doc. 632 issued Apr. 16, 1908.* 7–35263

DISTRICT OF COLUMBIA.

An act to protect the fish in the Potomac River in the District of Columbia, and to provide a spawning ground for shad and herring in the said Potomac River. Bulletin, 1885 (1885), vol. V, p. 180. F18–399

U. S. Commissioner of Fisheries: [Protection of fish in the Potomac River.] Report, 1894 (1896), p. 19.

MARYLAND.

Knight, William: A bill proposed to the Maryland legislature at the session of 1876, and entitled "An act to regulate the catching and to provide for the preservation of fish in waters of the State and of the Potomac River." Bulletin, 1882 (1883), vol. II, p. 265-272. F18-101

MASSACHUSETTS.

Atwood, Nathaniel E.: Fisheries on the east coast of Massachusetts. Remarks of Mr. Atwood, of the cape district, in relation to the petition to prohibit net and seine fisheries. Report, 1871 and 1872 (1873), p. 117-124. F16-54

Massachusetts Laws, Statutes, etc.: Draught of law proposed for the consideration of the enactment by the legislatures of Massachusetts, Rhode Island, and Connecticut. A bill to regulate the use of stationary apparatus in the capture of fish. Report, 1871 and 1872 (1873), p. 132-134. F16-56

——— [Petition to restrict fishing in Massachusetts.] Bulletin, 1886 (1887), vol. VI, p. 406-407.

——— [Legislation for the protection of mackerel.] *Quoted by* Goode *in* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. II, p. 301-304.

U. S. Bureau of Fisheries: Report of conference of United States commissioner with commissioners of Rhode Island and Massachusetts. Report of conference held at Boston, October 5, 1871, with fishery commissioners of Massachusetts and Rhode Island. Report, 1871 and 1872 (1873), p. 125-131. F16-55

MICHIGAN.

Laflin & co.: Need of a national law to regulate the size of mesh of both pound and gill nets on the Great Lakes. Bulletin, 1884 (1884), vol. IV, p. 223-224. F18-292

U. S. Bureau of Fisheries: [Laws, correspondence, and judicial proceedings regarding fish-cultural work in Michigan.] Report, 1904 (1905), p. 9-13.

NEW JERSEY.

Homergue, Louis C. d': Brief of the objections made before Leon Abbott, Governor of New Jersey, to the "Act to prohibit fishing by steam vessels with shirred or purse seines in any of the waters within the jurisdiction of the State of New Jersey." Bulletin, 1884 (1884), vol. IV, p. 189-190. F18-278

Miller, W. B.: An act to prohibit fishing by steam vessels with shirred or purse seines in any of the waters within the jurisdiction of the State of New Jersey. Bulletin, 1884 (1884), vol. IV, p. 187-189. F18-277

PENNSYLVANIA.

Rathbun, Richard: [Effect of pollution on the fisheries of the Susquehanna River. Report, 1892 (1894), p. CXXXVI-CXXXVIII.

RHODE ISLAND.

Rhode Island, General Assembly: Report of committee of Rhode Island legislature, made at Newport, June 15, 1870. (Signed Francis Brinley, Joseph Osborn, Joseph W. Sweet, Henry T. Grant, Jabez W. Mowry.) Report, 1871 and 1872 (1873), p. 104-111. F16-52

Rhode Island, General Assembly, Senate Committee on Fisheries: Pleadings before the Senate committee on fisheries of the Rhode Island legislature at its January session of 1872. Argument of J. Talbot Pitman in favor of a law prohibiting the use of traps and pounds in Rhode Island. Abstract of an address by Captain Nathaniel Atwood, in opposition to legislation. Before the Senate committee of Rhode Island legislature, January session, 1872. Report, 1871-72 (1873), p. 196-227. F16-61

U. S. Bureau of Fisheries: Special arguments in regard to regulating the sea fisheries by law. Argument of Samuel Powell, esq., delivered in the Rhode Island legislature. Argument of J. M. K. Southwick. The food fishes of the New England coast. By George H. Palmer. Report, 1871-72 (1873), p. 73-103. F16-51

WASHINGTON.

Washington Legislature: [An act regulating salmon fisheries of the waters of the Columbia River.] Report, 1877 (1879), p. 791-796.

Washington Territory, Legislature: [Developing the fisheries of Washington.] Bulletin, 1886 (1887), vol. VI, p. 132–133.

GREAT LAKES.

The Commercial, Port Huron, Mich.: [Regulating the Lake fisheries.] Bulletin 1886 (1887), vol. VI, p. 461–462.

Keyes, C. M.: The fishing industry of Lake Erie, past and present. Bulletin, 1893 (1894), vol. XIII, p. 349–352. *Doc. 271 issued June 26, 1894.* F12–183

McCallum, G. A.: The assimilation of the fishery laws of the Great Lakes. Bulletin, 1893 (1894), vol. XIII, p. 17–20. *Doc. 238 issued June 9, 1894.* F12–183

Milner, James W.: [Need of legislation for the protection of the food fishes of the Great Lakes.] Report, 1872 and 1873 (1874), p. 20–24.

MISSISSIPPI AND OHIO RIVERS.

Stringham, Emerson: Fish laws of Mississippi River States; a digest of statutes relating to the protection of fish and miscellaneous aquatic animals bordering on the Mississippi River. Appendix IV, Report, 1916 (1917), 16 p. *Doc. 840 issued Feb. 1, 1917.* F17–44

——— Fish laws of States bordering on Mississippi and Ohio rivers. A digest of statutes relating to the protection of fishes and other cold-blooded aquatic animals. Appendix II, Report, 1918 (1920), 21 p. *Doc. 866 issued July 8, 1919.* F19–31

EUROPE.

AUSTRIA.

Peyrer, Karl: Fisheries and fishery laws in Austria and of the world in general. Report, 1873–74 and 1874–75 (1876), p. 570–679. F16–31

BELGIUM.

Selys-Longchamps, Edmond, i. e. Michel Edmond Selys de: Repopulation of the water courses in Belgium. Report, 1881 (1884), p. 815–824. F16–343

ICELAND.

Thorarinsson, Bened S.: [Protecting the fisheries.] Bulletin, 1887 (1889), vol. VII, p. 124.

ITALY.

Worthington, John: The fisheries of Malta. Bulletin, 1885 (1885), vol. V, p. 457–462. F18–509

RUSSIA.

Russia: [Fishery regulations in Manchooria.] Bulletin, 1886 (1887), vol. VI, p. 451.

SCOTLAND.

Scotland, Fishery Board: [Extracts from the first annual report of the fishery board of Scotland for the year ending December 31, 1882.] (The effect of fixed engines on the salmon fisheries. A prize essay on "Salmon legislation in Scotland," by J. M. Leith: p. 230–234.) Report, 1882 (1884), p. 229–236.

INDIA.

Day, Francis: [Legislation on the fisheries of India.] Report, 1883 (1885), p. 392–401.

HAWAIIAN ISLANDS.

Cobb, John Nathan: [Fishery laws of the Hawaiian Islands.] Report, 1904 (1905), p. 435–438.

Jordan, David Starr: [Laws relating to the fishes and fisheries of the Hawaiian Islands.] Report, 1901 (1902), p. 359–373.

INTERNATIONAL.

American-Canadian Boundary Commission: Recommendations for the preservation of the fisheries in contiguous waters of the United States and Canada. Report, 1897 (1898), p. CV–CXVII.

Fryer, Charles Edward: International regulations of the fisheries on the high seas. Bulletin, 1908 (1910), vol. XXVIII, p. 91–102. *Doc. 647 issued June 1910.* 10–35097

Great Britain, Laws, Statutes, etc., 1837-1901 (Victoria): The British sea fisheries act, 1883. (An act to carry into effect an international convention concerning the fisheries in the North Sea, and to amend the laws relating to British sea fisheries.) Report, 1883 (1885), p. 259–278. F17–24

James, Bushrod W.: International protection for the denizens of the sea and waterways. Bulletin, 1897 (1898), vol. XVII, p. 257–263. *Doc. 378 issued Aug. 8, 1898.* F12–110

Jordan, David Starr: Work of the International fisheries commission of Great Britain and the United States. Bulletin, 1908 (1910), vol. XXVIII, p. 181–186. *Doc. 649 issued January, 1910.* 10–35100

Olsen, O. T.: International regulations of the fisheries on the high seas. Bulletin, 1908 (1910), vol. XXVII, p. 77–90. *Doc. 646 issued 1910.* 10–35098

Resolutions asking for the abrogation of the fishery clause of the Washington treaty, passed at a convention of New England fishermen, which met at Gloucester, December 27, 1884. Bulletin, 1885 (1885), vol. V, p. 447–448. F18–504

Stevenson, Charles Hugh: International regulations of the fisheries on the high seas. Bulletin, 1908 (1910), vol. XXVIII, p. 103–180 incl. 3 maps. *Doc. 648 issued January, 1910.* 10–35122

SPECIES.

BLUEFISH.

Dickinson, Fred. W.: Petition to prohibit the seining of bluefish. Bulletin, 1885 (1885), vol. V, p. 425–426. F18–492,

COD.

A petition [for the passage of a law prohibiting the catching of cod by trawl line] to the Fish commission of the United States, signed by the fishermen of Block Island, June 12, 1877. Report, 1878 (1880), p. 35–39. F16–152

HERRING.

Earll, R. E.: Proposed limitation of the herring fishery in Maine, and its effects upon bait and canning interests. Bulletin, 1883 (1883), vol. III, p. 445–446. F18–177

MACKEREL.

Goode, George Brown: [Legislation for the protection of mackerel.] Report, 1881 (1884), p 209–213.

Small, E. E.: [Petition for protective laws on mackerel.] Bulletin, 1885 (1885), vol. V, p. 350–351

U. S. Congress, House: An act relating to the importing and landing of mackerel caught during the spawning season. Bulletin, 1886 (1887), vol. VI, p. 216–217. F18–580

MENHADEN.

Greer, Rob Leon: The menhaden industry of the Atlantic coast. (Laws governing menhaden fishing: p. 27.) Appendix III, Report 1914 (1915), 27 p., VII pl. *Doc. 811 issued Apr. 7, 1915.* F15–39

—— The menhaden industry of the Atlantic coast, 30 p., VII pl. *Doc. 811 reprinted with additions Oct. 18, 1917.* F17–263

Homergue, Louis C. d': Reasons for restricting the use of steerers and seines in menhaden industry. Bulletin, 1883 (1883), vol. III, p. 456–458. F18–185

Wharton, Joseph: Why menhaden seining should not be prohibited within two miles of the shore. Bulletin, 1883 (1883), vol. III, p. 462. F18–187

SALMON.

California State Fisheries Commissioners: [Closed season for salmon.] Report, 1878 (1880), p. 892–893.

Cobb, John Nathan: The salmon fisheries of the Pacific coast. (Fishery regulations: p. 37–45.) Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

Dowell, B. F.: [Protection of salmon in Oregon.] Bulletin, 1886 (1887), vol. VI, p. 452.

McDonald, Marshall: [Protective regulation of the salmon fisheries of Alaska.] Bulletin, 1892 (1894), vol. XII, p. 13–20.

McDonald, Marseall: [Recommendation for legislation for protection of salmon fisheries.] Report, 1894 (1896), p. 101.

Moser, Jefferson F.: [Alaska salmon law.] Bulletin, 1898 (1899), vol. XVIII, p. 38–42.

Rathbun, Richard: [Regulations affecting the salmon fishery.] Report, 1899 (1900), p. 325–327.

U. S. Congress, House: [Resolution to investigate the Oregon salmon fishery.] Bulletin, 1886 (1887), vol. VI, 410–411.

SARDINE.

Hall, Ansley: [Legislation for regulating the sardine industry.] Report, 1896 (1898), p. 480–482.

STURGEON.

New Jersey, General Assembly, Senate: [A law protecting young sturgeon.] Report, 1899 (1900), p. 373.

MODUS VIVENDI.

Smith, Hugh McCormick: [Modus vivendi.] Report, 1889–1891 (1893), p. 201.

PATENTS.

Dyrenforth, Robert G.: List of patents issued in the United States, Great Britain, and Canada, up to the year 1878, relating to fish and the methods, products, and applications of the fisheries. Report, 1878 (1880), p. 3–16. F16–150

——— Abstract of patents issued in Great Britain up to the year 1878, and having reference to the pursuit, capture, and utilization of the products of the fisheries. Report, 1878 (1880), p. 17–33, pls. F16–151

——— List of patents issued in the United States during the years 1879, 1880, and 1881 relating to fish and the methods, products, and applications of the fisheries. Report, 1880 (1883), p. 1047–1060; 1881 (1884), p. 87–88. F16–280

——— Patents issued by the United States during the years 1882, 1883, and 1884 relating to fish and the methods, products, and applications of the fisheries. Report, 1885 (1887), p. 975–1099.

U. S. Bureau of Fisheries: List of patents granted by the United States to the end of 1872 for inventions connected with the capture, utilization, or cultivation of fishes and marine invertebrates. Report, 1871–72 (1873), p. 275–280. F16–62

——— [McDonald patents.] Report, 1903 (1905), p. 24.

TREATIES.

Baird, Spencer Fullerton: [Treaty of Washington. Testimony given before the Halifax commission, October, 1877.] Report, 1886 (1889), p. 171–213.

Peyrer, Karl: [Text of treaty between Baden and Switzerland, relating to fisheries in the Rhine.] Report, 1873–74 and 1874–75 (1876), p. 671–674.

Resolutions asking for the abrogation of the fishery clause of the Washington treaty, passed at a convention of New England fishermen which met at Gloucester, December 27, 1884. Bulletin, 1885 (1885), vol. V, p. 447–448.

Smith, H. M.: [Effect of abrogation of treaty of Washington on the herring fisheries.] Report,1889–1891 (1893) p. 201–202.

[**Termination** of the treaty of Washington in 1885.] Bulletin, 1884 (1884), vol. IV, p. 317.

U. S. Commissioner of Fisheries: [Halifax convention. Treaty of Washington.] Report, 1877 (1879), p. 6–13.

——— [Treaty relations with Great Britain.] Report, 1885 (1887), p. LXX–LXXII.

——— [Fishery relations of the United States with Canada.] Report, 1886 (1889), p. XXI–XXVII.

——— [North Atlantic fisheries dispute and arbitration.] Report, 1911 (1913), p. 52–59.

FISHERY METHODS.

UNITED STATES.

APPARATUS AND APPLIANCES.

Alexander, Alvin Burton: [Hook and line for Pacific salmon.] Report, 1902 1904), p. 154–155.

Baird, Spencer Fullerton: Description of apparatus used in capturing fish on the sea-coast and lakes of the United States. Report, 1871 and 1872 (1873), p. 258–274, illus., pl. XXXIX. F15–101

Beckley, Emma Metcalf: Hawaiian fishing implements and methods of fishing. Bulletin, 1886 (1887), vol. VI, p. 245–256. F18–585

Christensen, R.: Notes on the history of the fish-hook. Bulletin, 1884 (1884), vol. IV, p. 282–286. F13–105

Cobb, John Nathan: The salmon fisheries of the Pacific coast. (Apparatus and methods of fishing: p. 23–34.) Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

——— [Apparatus and methods of fishing in the Hawaiian Islands.] Report, 1901 (1902), p. 396–423.

——— [Apparatus and methods of fishing in the Hawaiian Islands.] Bulletin, 1903 (1905), vol. XXIII, pt. II, p. 721–743.

Collins, Joseph William: [Apparatus for fishing, collecting, etc., on the schooner *Grampus*.] Report, 1887 (1891), p. 470–476.

——— [Apparatus of capture and methods of fishery on the Pacific coast.] Report, 1888–89 (1892), p. 46–47, 58–60, 64–65, 103–105, 129–132, 147–149, 165–166, 172–173, 209–220, 241, 254–260.

Earll, R. Edward: [Methods of capture used by cod-fishermen of Cape Anne.] Report, 1878 (1880), p. 693–696.

Goode, George Brown, and J. W. Collins: [Apparatus and methods of the haddock fishery.] Bulletin, 1881 (1882), vol. I, p. 228–233.

Harrell, J. Dock: Trapping gaspereau in Tangipahoa River. Bulletin, 1884 (1884), vol. IV, p. 448. F18–361

Jordan, David Starr: [Apparatus used in the fisheries of the Hawaiian Islands.] Report, 1901 (1902), p. 378.

Kinney, Aug. C.: Proposed removal of fish-traps from Columbia River. Bulletin, 1885 (1885), vol. V, p. 328. F18–467

Martin, Stephen J.: Coal ashes as a means of raising mackerel in purse seines. Bulletin, 1881 (1882), vol. I, p. 65. F18–23

——— Method of using Willard's patent pocket for mackerel. Bulletin, 1881 (1882), vol. I, p. 65–66. F18–24

Merchant, George: The incipiency of night-seining for mackerel. Bulletin, 1884 (1884) vol. IV, p. 142. F18–251

Rathbun, Richard: [Methods of fishing for salmon in Washington.] Report, 1899 (1900), p. 295–316.

Scudder, Newton Pratt: [Apparatus and methods used in the halibut fishery in Davis Strait.] Report, 1880 (1883), p. 209–213.

Smith, Hugh McCormick: [Report on the line fisheries of the Middle Atlantic States.] Bulletin, 1894 (1895), vol. XIV, p. 461–462.

Stone, Livingston: [Methods of fishing for salmon in the Columbia River.] Report, 1875–76 (1878), p. 820–821.

Tann er, Zera Luther: The use of the electric light in fishing. Bulletin, 1885 (1885) vol. V, p. 464. F18–511

Use of light in sea-fishing. Bulletin, 1884 (1884), vol. IV, p. 387–389. F18–344

Van Hook, J. C.: [Methods of fishing for Barracuda on the Pacific coast.] *Quoted, by* Collins. Report, 1888–89 (1892), p. 30–31.

Widegren, Hjalmar: [Salmon-fishing with lines.] Report, 1878 (1880), p. 140–141.

Wilcox, William A.: [Apparatus and methods of Porto Rican fishermen.] Bulletin, 1900 (1902), vol. XX, pt. I, p. 30–32, illus.

FISHING VESSELS.

Baird, Spencer Fullerton: [The fishery marine.] Report, 1886 (1889), p. 103–108.

Cobb, John Nathan: [Vessels used in the sturgeon fishery of Delaware River and Bay.] Report, 1899 (1900). p. 374–375.

——— [Hawaiian fishing boats.] Bulletin, 1903 (1905), vol. XXIII, pt. II, p. 719–725.

Collins, Joseph William: [The proper model for fishing vessels.] Bulletin, 1885, (1885), vol. V, p. 69–70.

——— [Vessels and smacks used in the Gulf fisheries.] Report, 1885 (1887), p. 283–287, 250–254, 260–262, 264–267.

——— [Vessels and boats used in the fisheries of the Great Lakes.] Report, 1887 (1891), p. 19–30.

——— Report on the construction and equipment of the schooner *Grampus*. Report, 1887 (1891), p. 437–490, illus., XVIII pl. *Doc. 171 issued Aug. 24, 1891.* F11–333

——— The fishing vessels and boats of the Pacific coast. Bulletin, 1890 (1892), vol. X, p. 13–48, illus. pl. X–XVII. *Doc. 187 issued Feb. 15, 1892.* F12–134

Goode, George Brown: [Manner of fitting a vessel for swordfishing.] Report, 1880 (1883), p. 350.

Goode, George Brown, and Joseph William Collins: [The mackerel fleet.] Bulletin 1881 (1884), p. 139–142.

——— [Type of vessel composing the winter haddock fleet.] Bulletin, 1881 (1882), vol. I, p. 227–228.

Smiley, Charles W.: The proposed use of steamers in the mackerel fishery. Bulletin, 1882 (1883), vol. II, p. 155–158. F12–354

——— Tonnage of vessels of the United States employed in the whale, cod, and mackerel fisheries from 1860 to 1882, inclusive. Bulletin 1883 (1883), vol. III, p. 273. F18–133

Smith, Hugh McCormick: [Improvements in fishing vessels.] Report, 1892 (1894), p. CLXXX.

Stevenson, Charles Hugh: [Vessels and boats used in the coast fisheries of Texas.] Report, 1889–1891 (1893), p. 376.

Swan, James G.: [Schooner *Spencer F. Baird.*] Bulletin, 1885 (1885), vol. V, p. 342.

U. S. Bureau of Fisheries: Statistics respecting certain features of the vessel fisheries of the United States. Bulletin 1887 (1889), vol. VII, p. 447–464. F18–681.

NETS, DESCRIPTION OF.

Augur, C. H.: Fish nets: some account of their construction and the application of of the various forms in American fisheries. Bulletin, 1893 (1894), vol. XIII, p. 381–388. *Doc. 274 issued June 16, 1894.* F12–183

Dunlap, M. E.: Pound and net fishing at Erie, Penn. Bulletin, 1885 (1885), vol. V, p. 319–320. F18–463

Prices of small nets. Bulletin 1884 (1884), vol. IV, p. 359.

Stevenson, Charles Hugh: [Seines and nets used in the coast fisheries of Texas.] Report for 1889–1891 (1893), p. 377–382.

NETS, GILL.

Goode, George Brown, and Joseph William Collins: [The mackerel gill-net fishery.] Report, 1881 (1884), p. 197–202.

Martin, S. J.: Some of the early results of the introduction of cod gill-nets at Gloucester, Massachusetts, 1880–81. Bulletin, 1883 (1883), vol. III, p. 153–158. F20–137

——— Notes on the cod gill-net fisheries at Gloucester, Massachusetts, 1882–83 and 1883–84. Bulletin, 1883 (1883), vol. III, p. 159–160; 1884 (1884), vol. IV, p. 129–134. F20–135

——— Fitting out with cod gill-nets. Bulletin, 1883 (1883), vol. III, p. 424. F20–133

Smith, Hugh McCormick: [A statistical report on the seine gill-net, fyke-net, and pot fisheries of the Middle Atlantic States.] Bulletin, 1894 (1895), vol. XIV, p. 455–460.

U. S. Commissioner of Fisheries: [Introduction of cod gill-nets.] Report, 1881 (1884), p. XXXIV–XXXVIII.

——— [Cod gill-nets.] Report, 1883 (1885), p. LXIX–LXXI.

——— [Introduction of cod gill-nets on the Pacific coast.] Report, 1884 (1886), p. XLIV–XLV.

——— [Use of the cod gill-net.] Report, 1885 (1887), p. LXII–LXIII.

——— [Gill-nets in the mackerel fishery.] Report, 1905 (1906), p. 32–33.

NETS, FYKE.

Smith, Hugh McCormick: The fyke-nets and fyke-net fisheries of the United States, with notes on the fyke-nets of other countries. Bulletin, 1892 (1894), p. 299–355, Pl. LXXII–XCI. *Doc. 226 issued Nov. 9, 1895.* F12–164

NETS, PURSE.

Deblois, E. T.: [Invention of the purse seine.] Bulletin, 1881 (1882), vol. I, p. 47.

Goode, George Brown, and Joseph William Collins: [The purse-seine in the mackerel fishery.] Report, 1881 (1884), p. 138–171.

U. S. Commissioner of Fisheries: [Purse-seine in the Bank cod fishery.] Report, 1905 (1907), p. 30.

Wallem, Fredrik Meltzer: [Mackerel-catching with the purse-seine.] Report 1878 (1880), p. 108–113.

NETS, PRESERVATION OF.

Hearder, William: Waterproofing for herring-nets. Bulletin, 1884 (1884), vol. IV, p. 143. F18-253

The Preservation of nets. Bulletin, 1886 (1887), vol. VI, p. 97-104. F18-548

Storer, Francis Humphreys: Memoranda of methods employed by fishermen for barking and in other ways preserving nets and sails. Report, 1882 (1884), p. 295-308. F16-331

Taylor, Harden F.: Preservation of fish nets. (Citation of literature: p. 34.) Appendix IV, Report, 1920 (192–), 35 p., illus. *Doc. 898 issued Feb. 2, 1921.* F21-5

U. S. Commissioner of Fisheries: [Best methods of preserving nets.] Report, 1882 (1884), p. XX.

TRAWLS AND TRAWLING.

Alexander, Alvin Burton; H. F. Moore; and W. C. Kendall: Otter-trawl fishery. Appendix VI, Report, 1914 (1915), 97 p., illus., fold. chart, fold. pl. (First printed as House doc. 1519, 63d Cong., 3d sess.) *Doc. 816 issued Apr. 17, 1915.* F15-40

Baird, Spencer Fullerton: [Description of the beam-trawl.] Report, 1886 (1889), p. 121-123.

Smith, Hugh McCormick: [Beam-trawl fishery.] Report, 1892 (1894), p. CLXXXI-CLXXXII.

U. S. Bureau of Fisheries: [Otter-trawl fishery of Boston.] Report, 1913 (1914), p. 59-60.

Wilcox, William A.: [Use of the beam-trawl in the fisheries of the Pacific coast.] Report, 1893 (1895), p. 214-215.

EUROPE.

APPARATUS AND APPLIANCES.

Eels and eelpots in Norway. Bulletin, 1885 (1885), vol. V, p. 306. F18-451

Johnston, Joseph, & Sons: Scotland fisheries and apparatus. Bulletin, 1883 (1883), vol. III, p. 466. F18-190

Lehrs, George Lambert: [Fishing in the Black Sea.] Bulletin, 1885 (1885), vol. V, p. 84-85.

Leith, J. M.: [Effects of fixed engines on salmon fisheries.] Report, 1882 (1884), p. 230-234.

Ljungman, Axel Vilhelm: [Fishing implements, the manner in which they are used.] Report, 1873-74 and 1874-75 (1876), p. 154-165.

Lundberg, Rudolph: Eel-fishing with so-called "hommer" (a species of fish-pot) on the Baltic coast of Sweden and in the Sound. Report, 1883 (1885), p. 415-430, pl., illus. F17-33

FISHING VESSELS.

Ancher, Ernst: The *Kurren* and *Keitel* (fishing vessels) of the Courland Haff. Bulletin, 1884 (1884), vol. IV, p. 167-168. F18-263

Annaniassen, A.: [Iceland fishing vessels.] Report, 1884 (1886), p. 321-322.

Collins, J. W.: Suggestions for the employment of improved types of vessels in the market fisheries, with notes on the British fishing steamers. Bulletin, 1888 (1890), vol. VIII, p. 175-192, pl. XVI-XXVII. *Doc. 137 issued Mar. 15, 1890.* F11-319

NETS, DESCRIPTION OF.

Ljungman, Axel Vilhelm: [Description of nets used in the herring fisheries on the coast of Bohuslan.] Report, 1884 (1886), p. 403-408.

Lundberg, Rudolph: [Methods employed in the fisheries of Sweden. Description of nets.] Report, 1884 (1886), p. 363-398.

NETS, GILL.

Collins, Joseph William: Gill-nets in the cod-fishery. (Description of the Norwegian cod-nets, with directions for their use, and a history of introduction into the United States.) Bulletin, 1881 (1882), vol. I, p. 1-7, pl. I-XII. *Doc. 37 issued June 30, 1881.* F12-219

——— Correspondence relative to the procurement of certain fishery implements for the government of New South Wales. Bulletin, 1882 (1883), vol. II, p. 291-299. F18-104

——— Gill-nets in the cod-fishery: a description of Norwegian cod-nets, etc., and a history of their use in the United States. Report, 1884 (1886), p. 265-288. F17-127

NETS, PURSE.

Anderssen, Joakim: [Use of the purse-seine in open sea.] Report, 1878 (1880), p. 60–61.

Ljungman, Axel Vilhelm: [Introduction of the purse-seine into Europe.] Report, 1884 (1886), p. 407–408.

Martin, S. J.: The American purse-seine successful in the herring fisheries of Sweden. Bulletin, 1883 (1884), vol. III, p. 161. F20–130

TRAWLS AND TRAWLING.

Collins, Joseph William: The beam-trawl fishery of Great Britain, with notes on beam-trawling in other European countries. Bulletin, 1887 (1889), p. 289–402, illus., XXIII pl. (partly fold.). *Doc. 132 issued Sept. 21, 1889.* F11–329

INDIA: APPARATUS AND APPLIANCES.

Day, Francis: [Apparatus and methods of fishery in India.] Report, 1883 (1885), p. 394–388.

SPECIAL FISHERIES.

UNITED STATES.

ALEWIFE.

General.

Smith, Hugh McCormick: [Shad and alewife fisheries.] Report, 1897 (1898), p. CXXV–CXXX.

——— Notes on the extent and condition of the alewife fisheries of the United States in 1896. Report, 1898 (1899), p. 31–43. *Doc. 401 issued Mar. 22, 1899.* F11–113

Maine.

Evermann, Barton Warren: [Alewife fishery of the Penobscot River.] Report, 1903 (1905), p. 112.

New England.

Smith, Hugh McCormick: [The alewife fishery in New England.] Report, 1894 (1896), p. 125.

ATKAFISH: ALASKA.

Collins, Joseph William: [Atka fishery in the Aleutian Archipelago.] Report, 1888–89 (1892), p. 16–17.

Turner, Lucien McShan: [Atka fishery.] *Quoted by* Evermann and Goldsborough. Bulletin, 1906 (1907), vol. XXVI, p. 291–292.

BARRACUDA: CALIFORNIA.

Eigenmann, Carl H.: [The barracuda and the fishery for it.] *Quoted by* Collins. Report, 1888–89 (1892), p. 26–27.

Van Hook, J. G.: [Fishing for barracuda.] *Quoted by* Collins. Report, 1888–89 (1892), p. 30.

BASS.

General.

Collins, J. W.: [The rock and perch fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. VII, p. 538–540.

Page, William F.: [Black basses.] Report, 1897 (1898), p. 164–165.

[Striped bass (*Roccus lineatus*).] Bulletin, 1886 (1887), vol. VI, p. 137.

Wilcox, William A.: [Striped bass fisheries of the Pacific coast.] Report, 1893 (1895), p. 149–151.

California.

[Striped bass in California.] Report, 1897 (1898), p. CXLI–CXLIII.

CARP.

General.

Brouster, E. B.: [How to catch carp.] Bulletin, 1886 (1887), vol. VI, p. 317.

Canfield, Harry L.: The capture and marketing of carp. Seasons and localities of capture. 7 p. *Economic Circular 40 issued Sept. 20, 1918.* F18–699

Cole, Leon J.: The German carp in the United States. Report, 1904 (1905), p. 523-641, illus., pls. *Doc. 592 issued Dec. 30, 1905.* F12-327

Ebert, Amos: [Catching carp with a hook.] Bulletin, 1886 (1887), vol. VI, p. 135.

Martin, Robert A.: How to catch carp. Bulletin, 1885 (1885), vol. V, p. 449-450. F18-506

Quattlebaum, Paul: Method of catching carp with a hook. Bulletin, 1884 (1884), vol. IV, p. 380. F18-338

Shinkle, A.: [Game qualities of the carp.] Bulletin, 1886 (1887), vol. VI, p. 317.

Smiley, Charles Wesley: Several opinions upon how to catch carp. Bulletin, 1884 (1884), vol. IV, p. 268-272. F18-309

Tcherkassoff, P.: [Carp fishing.] Bulletin, 1885 (1885), vol. V, p. 106-107.

Townsend, Charles Haskins: [Note on carp fishery.] Report, 1900 (1901), p. 178.

——— [Carp fisheries.] Report, 1902 (1904), p. 153.

Illinois.

Chicago Tribune: [Carp in Illinois.] Bulletin, 1886 (1887), vol. VI, p. 401.

Ohio.

Mulertt, Hugo: [Carp in the Ohio River.] Bulletin, 1886 (1887), vol. VI, p. 401.

Virginia.

Duke, R. T. W.: [Carp in the Rivanna River.] Bulletin, 1886 (1887), vol. VI, p. 134.

Lynchburg Advance: [Carp in the Rivanna River.] Bulletin, 1886 (1887), vol. VI, p. 134.

Page, W. F.: [Carp in the James River.] Bulletin, 1886 (1887), vol. VI, p. 316.

Lake Erie.

Townsend, Charles Haskins: [German carp in Lake Erie.] Report, 1901 (1902), p. 150-151.

CATFISH.

General.

Avery, F. W.: [A large catfish.] Bulletin, 1886 (1887), vol. VI, p. 453.

Hiester, Charles E.: Answers to questions relative to catfish. Bulletin, 1882 (1883), vol. II, p. 76-79. F18-76

Kendall, William Converse: American catfishes: habits, culture, and commercial importance. Report and special papers, 1908 (1910), 39 p., X pl. *Doc. 733 issued Aug. 23, 1910.* 10-35947

California.

Utter, William: [Catfish and shad in California.] Bulletin, 1886 (1887), vol. VI, p. 315.

Louisiana.

Evermann, Barton Warren: Report on investigations [of the catfish industry] by the United States Fish commission in Louisiana . . . in 1897. Report, 1898 (1899), p. 290-301. *Doc. 405 issued Mar. 21, 1899.* F11-117

COD.

General.

Alexander, Alvin B.: [Notes on fishery investigations from July 1 to 26, 1894.] Report, 1895 (1896), p. 139-145.

Collins, J. W.: [Gill-nets in the cod-fishery in the United States.] Bulletin, 1881 (1882), vol. I, p. 1-17, pl. I-XII.

——— Notes on the habits and methods of capture of various species of sea birds that occur on the fishing banks off the eastern coast of North America, and which are used as bait for catching codfish by New England fishermen. Report, 1882 (1884), p. 311-338, pl. F16-311

——— Some observations on the cod gill-net fisheries and on preservatives for nets. Bulletin, 1884 (1884), vol. IV, p. 58-59. F18-220

——— Gill-nets in the cod-fishery: a description of Norwegian cod-nets, etc., and a history of their use in the United States. Report, 1884 (1886), p. 265-288. F17-127

Dambeck, Carl: Geographical distribution of the Gadidæ or the cod family, in its relation to fisheries and commerce. Report, 1877 (1879), p. 531-557. F16-108

Goode, G. Brown, and J. W. Collins: The cod, haddock and hake fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 1, pt. II, p. 123–243 incl. tables.

Success of cod gill-net fishery. Bulletin, 1883 (1883), vol. III, p. 416.

Wilcox, William A.: Reappearance of young cod hatched by the U. S. Fish commission. Bulletin, 1883 (1883), vol. III, p. 439. F18–170

Alaska.

Bower, Ward Taft: Alaska fisheries and fur industries. (Cod fisheries.) Appendix VII, Report, 1918 (1920), p. 58–61; Appendix IX, Report, 1919 (1921), p. 55–57. F12–388

Bower, Ward T., and Henry D. Aller: Alaska fisheries and fur industries. (Cod fisheries.) Appendix IX, Report, 1914 (1915), p. 53–55; Appendix III, Report, 1915 (1917), p. 54–57; Appendix II, Report, 1916 (1917), p. 68–71; Appendix II, Report, 1917 (1919), p. 47–49. F12–388

Bower, Ward Taft, and H. Clifford Fassett: [Cod fishery industry in Alaska: p. 122–123]. *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

Chamberlain, Frederick M., and Ward Taft Bower: [Cod fishery: p. 64–66.] *In* Fishery and fur industries in Alaska in 1912, by B. W. Evermann. Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12–388

Cobb, John Nathan: The commercial fisheries of Alaska. (Cod fishery: p. 9–14.) Report and special papers, 1905 (1907), 46 p. *Doc. 603 issued Oct. 16, 1906.* 6–35319

Cobb, John Nathan, and Frederick M. Chamberlain: [Cod fishery: p. 53–56.] *In* Alaska fisheries and fur industries in 1911, by B. W. Evermann. Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Cod fisheries: p. 45–48.) Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued May 16, 1907.* 7–35263

[A **codfish** bank near Noonivak Island.] Bulletin, 1885 (1885), vol. V, p. 337.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Cod fisheries: p. 44–48.) Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7–35263

——— The fisheries of Alaska in 1908. (Cod fisheries: p. 59–62.) Report and special papers, 1908 (1910), 78 p. *Doc. 645 issued Apr. 17, 1909.* 7–35263

——— The fisheries of Alaska in 1909. (Cod fisheries: p. 41–42.) Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20, 1910.* 7–35263.

——— The fisheries of Alaska in 1910. (Cod fisheries: p. 37–40.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Massachusetts.

Atwood, Nathaniel E.: Unexplained variations in the yield of oil from cod livers. Bulletin, 1883 (1883), vol. III, p. 431–432. F18–165

Earll, Edward R.: A report on the history and present condition of the shore cod-fisheries of Cape Ann, Mass., together with notes on the natural history and artificial propagation of the species. Report, 1878 (1880), p. 685–740. *Doc. 33 issued June 27, 1881.* F11–221

Haskell, E. H.: Second annual appearance of young cod hatched by the United States Fish commission in Gloucester Harbor in the winter of 1879–80. Bulletin, 1882 (1883), vol. II, p. 112. F18–84

Martin, Stephen J.: Cod-fishing with gill-nets in Ipswich Bay, Massachusetts. Bulletin, 1881 (1882), vol. I, p. 264, 343–345. F18–50, F20–132

——— Cod fishing with gill-nets from Gloucester, Massachusetts. Bulletin, 1881 (1882), vol. I, p. 384. F20–131

——— Notes on the cod gill-net fisheries of Gloucester, Mass., 1883–1884. Bulletin, 1884 (1884), vol. IV, p. 129–134, 191–192. F20–135

——— [Large catch of pollock.] Bulletin, 1886 (1887), vol. VI, p. 454.

Rathbun, Richard: [Cod fisheries—Massachusetts.] Report, 1889–1891 (1893), p. 155–157.

Spinney, Benjamin H.: Return to Gloucester of young codfish hatched by U. S. Fish commission in 1879. Bulletin, 1883 (1883), vol. III, p. 362. F18–147

Tarr, Ralph Stockman: Return to Gloucester Harbor of the young codfish hatched by the U. S. Fish commission. Bulletin, 1884 (1884), vol. IV, p. 57–58. F18–219

Maine.

Tibbetts, N. V.: Scarcity of cod and haddock on the coast of Maine. Bulletin, 1886 (1887), vol. VI, p. 75–76. F18–537

New England.

Collins, Joseph William: Success of the gill-net cod fishery on the New England coast, winter of 1882–83. Bulletin, 1883 (1883), vol. III, p. 441–443. F18–173

U. S. Commissioner of Fisheries: [Decrease of cod fisheries on the New England coast.] Report, 1872 and 1873 (1874), p. XI–XIV.

Chesapeake Bay.

Collins, J. W.: An inquiry as to the capture of young codfish in Chesapeake Bay. Bulletin, 1881 (1882), vol. I, p. 401–402. F20–118

Ryder, Francis W.: Codfish caught near Cape Charles, mouth of Chesapeake Bay, in 1834. Bulletin, 1881 (1882), vol. I, p. 384–385. F20–141

Pacific coast.

Alexander, Alvin B.: [Pacific coast cod fishery.] Report, 1904 (1905), p. 137–138.

Cobb, John Nathan: Pacific cod fisheries. (Bibliography: p. 108–111.) Appendix IV, Report, 1915 (1917), 111 p., IX pl., chart. *Doc. 830 issued Oct. 23, 1916.* F16–19

Collins, Joseph William: [Cod fishery of the Pacific coast of the United States.] Report, 1888–89 (1892), p. 91–109.

San Francisco Bulletin: [Codfish on the north Pacific coast in 1886.] Bulletin, 1886 (1887), vol. VI, p. 309–310.

Swan, James G.: [Codfish in the Pacific.] Bulletin, 1886 (1887), vol. VI, p. 131.

——— [Codfish on the Pacific coast.] Bulletin, 1886 (1887), vol. VI, p. 141.

U. S. Commissioner of Fisheries: [Cod fisheries.] Report, 1906 (1908), p. 17.

Wilcox, William A.: [The Pacific cod-fishery.] Report, 1893 (1895), p. 199–201.

EEL.

Alaska.

Derby, V. L.: [Catching eels with dip-nets.] *Quoted by* Evermann and Goldsborough. Bulletin, 1906 (1907), vol. XXVI, p. 227–228.

Maryland.

U. S. Bureau of Fisheries: Statistics of the fisheries of the Middle Atlantic States for 1904. (Eel fisheries, Maryland: p. 88.) Report and special papers, 1905 (1907), 122 p. *Doc. 609 issued Feb. 19, 1907.* 7–35091

Massachusetts.

Nye, Willard: [The eel in Westport River.] Bulletin, 1887 (1889), vol. VII, p. 33.

New York.

Cobb, J. N.: [Eel fishery in Oneida River, New York.] Report, 1903 (1905), p. 235.

FLOUNDER.

General.

U. S. Commissioner of Fisheries: [Flounder fishery.] Report, 1907 (1909), p. 16.

Massachusetts.

Alexander, Alvin Burton; Henry Frank Moore; and William Converse Kendall: Otter-trawl fishery. (Cape Cod flounder fishery: p. 56–57.) Report and special papers, 1914 (1915), 97 p. *Doc. 816 issued Apr. 17, 1915.* F15–40

Texas.

Stevenson, Charles Hugh: [Flounder fisheries of Texas.] Report, 1889–1891 (1893), p. 384–385.

GOURAMI.

Gill, Theodore Nicholas: Natural and economical history of the gourami (*Osphromenus goramy*). Report, 1872 and 1873 (1874), p. 710–728, pl. XXXV–XXXVI. *Doc. 9 issued Jan. 26, 1875.* F11–205

GRAYFISH.

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coasts of Washington and Oregon in 1914. (Dogfish fishery: p. 25.) Appendix VII, Report, 1914 (1915), p. 30. *Doc. 817 issued June 8, 1915.* F15–86

HADDOCK.

General.

Moore, H. F.: The haddock: one of the best salt-water fishes. 8 p., illus. *Economic Circular 47 issued Aug. 18, 1920.* F20-159

New England.

Goode, George Brown, and J. W. Collins: The winter haddock fishery of New England. Bulletin, 1881 (1882), vol. I, p. 225-235. *Doc. 31 issued 1881.* F12-238

HALIBUT.

General.

Broca, P. de: The halibut fishery of the United States. Report, 1873-74 and 1874-75 (1876), p. 169-171. F16-9

Collins, Joseph William: [Some localities where chicken halibut are found.] Bulletin, 1886 (1887), vol. VI, p. 412-413.

Goode, G. Brown, and Joseph William Collins: The fresh-halibut fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. I, p. 1-89, illus.

Scudder, Newton P.: The salt-halibut fishery, with especial reference to that of Davis' Straits. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. I, p. 90-119 incl. tables.

Alaska.

Bower, Ward Taft: Alaska fisheries and fur industries. (Halibut fisheries.) Appendix VII, Report, 1918 (1920), p. 57-58; Appendix IX, Report, 1919 (1921), p. 53. F12-388

Bower, Ward T., and Henry D. Aller: Alaska fisheries and fur industries. (Halibut fisheries.) Appendix IX, Report, 1914 (1915), p. 49-52; Appendix III, Report, 1915 (1917), p. 51-54; Appendix II, Report, 1916 (1917), p. 56-68; Appendix II, Report, 1917 (1919), p. 43-46. F12-388

Bower, Ward Taft, and H. C. Fassett: [Halibut fishery of Alaska: p. 116-122.] *In* Alaska fisheries and fur industries in 1913, by Barton Warren Evermann. Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12-388

Chamberlain, Fred M., and Ward T. Bower: [Halibut fishery: p. 60-64.] *In* Fishery and fur industries of Alaska in 1912, by Barton Warren Evermann. Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12-388

Cobb, John Nathan: The commercial fisheries of Alaska. (Halibut fishery: p. 15-19.) Report and special papers, 1905 (1907), 46 p. *Doc. 603 issued Oct. 16, 1906.* 6-35319

Cobb, John Nathan, and Frederick M. Chamberlain: [Halibut fishery: p. 56-59.] *In* Alaska fisheries and fur industries in 1911, by B. W. Evermann. Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12-388

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Halibut fishery: p. 48-51.) Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued May 16, 1907.* 7-35263

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Halibut fisheries: p. 48-53.) Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7-35263

——— The fisheries of Alaska in 1908. (Halibut fishery: p. 62-65.) Report and special papers, 1908 (1910), 78 p. *Doc. 645 issued Apr. 17, 1909.* 7-35263

——— The fisheries of Alaska in 1909. (Halibut fishery: p. 43-48.) Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20, 1910.* 7-35263

——— The fisheries of Alaska in 1910. (Halibut fishery: p. 40-45.) Report and special papers, 1910 (1911), 72 p *Doc. 746 issued Apr. 19, 1911.* 7-35263

Moser, Jefferson F.: [The halibut fisheries of Alaska.] Bulletin, 1898 (1899), vol. XVIII, p. 45-48.

—— [Halibut fisheries of southeastern Alaska.] Bulletin, 1901 (1902), vol. XXI, p. 309.

New England.

Boston Daily Advertiser: [Halibut getting scarce.] Bulletin, 1885 (1885), vol. V, p. 90.

Collins, J. W.: Notes on the halibut fisheries of 1881-82. Bulletin, 1882 (1883), vol. II, p. 311-316. F12-365

——— [Halibut fisheries.] Report, 1886 (1889), p. 709-710.

Scudder, Newton Pratt: The halibut fishery—Davis' Strait. Report, 1880 (1883), p. 189–228. *Doc. 43 issued Apr. 26, 1882.* F11–217

U. S. Commissioner of Fisheries: [Halibut fisheries.] Report, 1881 (1884), p. XXVII–XXVIII.

——— [Halibut fisheries.] Report, 1906 (1908), p. 17.

——— [Halibut fisheries.] Report, 1907 (1909), p. 16.

Pacific coast.

Alexander, A. B.: Notes on the halibut fishery of the northwest coast in 1895. Bulletin, 1897 (1898), vol. XVII, p. 141–144. *Doc. 359 issued Feb. 8, 1898.* F12–244

——— Preliminary examination of halibut fishing grounds of the Pacific coast. With introductory notes on the halibut fishery, by H. B. Joyce. Report and special papers, 1911 (1912), 56 p. *Doc. 763 issued July 22, 1912.* F12–203

——— [Halibut fisheries of the Pacific.] Report, 1904 (1905), p. 138–140.

Collins, Joseph William: [Halibut fisheries, Puget Sound.] Report, 1888–89 (1892), p. 260–267.

San Francisco Examiner: [A cargo of halibut.] Bulletin, 1894 (1895), vol. XIV, p. 285.

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coast of Washington and Oregon in 1914. (Halibut fishery: p. 22–23.) Appendix VII, Report, 1914 (1915), 30 p., pl., fold. tab., 2 fold. charts. *Doc. 817 issued June 8, 1915.* F15–86

U. S. Commissioner of Fisheries: [Pacific halibut fishery.] Report, 1911 (1913), p. 51–52.

Wilcox, William A.: The commercial fisheries of the Pacific Coast States for 1904. (Halibut fishery: p. 13–14.) Report and special papers, 1905 (1907), 74 p. *Doc. 612 issued Feb. 25, 1907.*

Bering Sea.

Krause, Earl E. H.: Cod and halibut fisheries near the Shumagin Islands. Bulletin, 1881 (1882), vol. I, p. 259–260. F18–47

HERRING.

General.

Earll, R. Edward: The herring fishery and the sardine industry. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. IV, p. 419–524.

Grant, Isaac H.: Catch of herring. Bulletin, 1883 (1883), vol. III, p. 470. F18–195

U. S. Commissioner of Fisheries: [The alewife or fresh-water herring.] Report, 1872 and 1873 (1874), p. LIX.

Alaska.

Bower, Ward Taft: Alaska fisheries and fur industries. (Herring fisheries.) Appendix VII, Report, 1918 (1920), p. 61–63; Appendix IX, Report, 1919 (1921), p. 54–55. F12–388

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries. (Herring fisheries.) Appendix IX, Report, 1914 (1915), p. 55–58; Appendix III, Report, 1915 (1917), p. 57–63; Appendix II, Report, 1916 (1917), p. 71–73; Appendix II, Report, 1917 (1919), p. 49–51. F12–388

Bower, Ward Taft, and Clifford H. Fassett: [Herring fishery: p. 97–122.] *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

Chamberlain, Frederick M., and Ward Taft Bower: [Herring fishery: p. 56–60.] *In* Fishery and fur industries of Alaska in 1912, by Barton W. Evermann. Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12–388

Cobb, John Nathan: The commercial fisheries of Alaska. (Herring fishery: p. 20–22.) Report and special papers, 1905 (1907), 46 p. *Doc. 603 issued Oct. 16, 1906.* 6–35319

Cobb, John Nathan, and Frederick M. Chamberlain: Alaska fisheries and fur industries in 1911. (Herring fishery: p. 59-63.) Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Herring fishery: p. 52–56.) Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued May 16, 1907.* 7–35263

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Herring fishery: p. 53–54.) Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7–35263

——— The fisheries of Alaska in 1908. (Herring fishery: p. 65.) Report and special papers, 1908 (1910), 78 p. *Doc. 645 issued Apr. 17, 1909.* 7–35263

——— The fisheries of Alaska in 1909. (Herring fishery: p. 48–50.) Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20, 1910.* 7–35263

——— The fisheries of Alaska in 1910. (Herring fishery: p. 45–51.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Maine.

Earll, R. Edward: Notes on certain fishery industries of Eastport, Maine, in 1886. Bulletin, 1887 (1889), vol. VII, p. 267–274. F18–675

Earll, R. Edward, and Hugh M. Smith: The American sardine industry in 1886. Bulletin, 1887 (1889), vol. VII, p. 161–192 incl. tables. *Doc. 123 issued June 20, 1889.* F11–252

Hall, Ansley: The herring industry of the Passamaquoddy region, Maine. Report, 1896 (1898), p. 443–487 incl. tables. *Doc. 360 issued 1897.* F11–183

Moore, Henry Frank: Observations on the herring and herring fisheries of the northeast coast, with special reference to the vicinity of Passamaquoddy Bay. Report, 1896 (1898), p. 387–442, pls. *Doc. 356 issued Feb. 8, 1898.* F11–182

Massachusetts.

Abbe, W. A.: Occurrence of herring. Bulletin, 1883 (1883), vol. III, p. 468–469. F18–192

Collins, J. W.: Notes on the herring fishery of Massachusetts Bay in the autumn of 1882. Bulletin, 1882 (1883), vol. II, p. 287–290. F12–364

U. S. Commissioner of Fisheries: [Herring fisheries in 1906.] Report and special papers, 1907 (1909), p. 15.

Potomac River.

Chapman, Pearson, sr.: Habits of the shad and herring as they appear in the Potomac River to one who has watched them for fifty years. Bulletin, 1884 (1884), vol. IV, p. 61–64. F13–81

Harris, Gwynn: Report upon the shad and herring fisheries of the Potomac River for 1882–1886. Bulletin, 1883 (1883), vol. III, p. 477; 1884 (1884), vol. IV, p. 13, 221; 1885 (1885), vol. V, p. 192; 1886 (1887), vol. VI, p. 202. F18–202

McDonald, Marshall: [Herring fisheries of the Potomac, during 1883.] Report, 1883 (1885), p. 1030–1031.

Puget Sound.

Swan, James G.: Notes on the fisheries and the fishery industries of Puget Sound. Bulletin, 1893 (1894), vol. XIII, p. 371–380, pl. 17. *Doc. 274 issued June 16, 1894.* F12–183

KINGFISH: FLORIDA.

Collins, Joseph William: [Kingfish fishery.] Report, 1885 (1887), p. 267–273.

MACKEREL.

General.

Abbe, W. A.: Proposed limitation * * * of mackerel fishing to June 15 * * *. Bulletin, 1883 (1883), vol. III, p. 468–469. F18–192

Blackford, Eugene Gilbert: [Cheap mackerel.] Bulletin, 1886 (1887), p. 459–460.

Chadwick, B. P.: Young mackerel destroyed by small-meshed seins. Bulletin, 1886 (1887), vol. VI, p. 193. F18–570

Collins, J. W.: Notes on the movements, habits, and capture of mackerel for the season of 1882. Bulletin, 1882 (1883), vol. II, p. 273–285. F12–363

——— Movements of mackerel in winter. Bulletin, 1884 (1884), vol. IV, p. 15. F18–205

——— [Mackerel fishery.] Report, 1887 (1891), p. 515–520.

Earll, R. Edward: The Spanish mackerel; its natural history and artificial propagation, with an account of the origin and development of the fishery. Report, 1880 (1883), p. 395–426. *Doc. 60 issued July 9, 1883.* F11–332

——— The Spanish mackerel fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. VIII, p. 543–552.

[The first mackerel catch of the season.] Bulletin, 1886 (1887), vol. VI, p. 460.

Goode, G. Brown, and J. W. Collins: The mackerel fishery of the United States. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 1, pt. II, p. 245–313 incl. tables.

Goode, George Brown; Joseph William Collins; R. E. Earll; and A. Howard Clark: Materials for a history of the mackerel fishery. (*Contents.*—Natural history, by G. B. Goode. The mackerel fishery of the United States, by G. B. Goode and J. W. Collins. Legislation for the protection of mackerel. Statistics of the mackerel fishery in 1880, by R. E. Earll. The mackerel canning industry, by R. E. Earll. Methods of packing, and inspection laws, by A. H. Clark. Statistics of inspection of mackerel from 1804 to 1880, by A. H. Clark. Chronological notes, by J. W. Collins. Inspection laws, comp. by A. H. Clark. The mackerel fleet. Mackerel fishery in the Gulf of Saint Lawrence.) Report, 1881 (1884), p. 91–531 incl. tables, chart. *Doc. 52 issued Jan. 3, 1883.* 7–38960

Holmes, John F.: [Movements of mackerel.] Bulletin, 1886 (1887), vol. VI, p. 137, 464.

Kendall, William Converse: Effects of the menhaden and mackerel fisheries upon the fish supply. Bulletin, 1908 (1910), vol. XXVIII, p. 279–293. *Doc. 658 issued February, 1910.* 10–35152

Low, D. W.: [Itinerary of a mackerel voyage to the Gulf of Saint Lawrence.] *Quoted by* Goode *in* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. II, p. 292–294.

McLain, Melvin: [A large catch of mackerel.] Bulletin, 1886 (1887), vol. VI, p. 137.

Merchant, George: The incipiency of night-seining for mackerel. Bulletin, 1884 (1884), vol. IV, p. 142. F18–251

Moore, J. Percy: The utility and methods of mackerel propagation. Bulletin, 1897 (1898), vol. XVII, p. 353–361. *Doc. 394 issued Aug. 8, 1898.* F12–110

——— Report on mackerel investigations in 1897. Report, 1898 (1899), p. 1–22, pls. *Doc. 399 issued Mar. 28, 1899.* F11–111

Phillips, Barnet: Early catch of mackerel. Bulletin, 1883 (1883), vol. III, p. 280. F18–136

Rathbun, Richard: [Investigation of the mackerel fishery.] Reports, 1889-1891 (1893), p. 129; 1893 (1895), p. 46–48; 1894 (1896), p. 91–94; 1895 (1896), p. 80–82; 1896 (1898), p. 103–105.

Smith, Hugh McCormick: [Mackerel fishery, Atlantic coast.] Report, 1889-1891 (1893), p. 188–190.

——— The southern spring mackerel fishery of the United States. Bulletin, 1898 (1899), vol. XVIII, p. 193–271. *Doc. 411 issued Oct. 19, 1899.* F12–97

——— [Races of mackerel on the Atlantic coast.] Report, 1900 (1901),p. 127–128.

Tanner, Zera Luther: Report on the work of the United States Fish Commission steamer *Albatross* for the year ending December 31, 1883. Report, 1883 (1885), p. 117–236. *Doc. 96 issued Aug. 16, 1886.* F11–303

Townsend, Charles Haskins: [The mackerel fishery.] Report, 1901 (1902), p. 149–150.

U. S. Bureau of Fisheries: Questions relative to mackerel and the mackerel fisheries. Bulletin, 1886 (1887), vol. VI, p. 425–427. F18–623

U. S. Commissioner of Fisheries: [Mackerel fisheries.] Report, 1906 (1908), p. 16-17; 1907 (1909), p. 14; 1909 (1911), p. 22–24; 1910 (1911), p. 28–30; 1915 (1917) p. 62.

Wilcox, W. A.: [The mackerel fisheries of 1885 and 1886.] Report, 1885 (1887), p. LXIII-LXV; 1886 (1889), p. XVII–XIX.

Florida.

Collins, J. W.: Note on the occurrence of mackerel off the coast of Florida. Bulletin, 1887 (1889), vol. VII, p. 128. F18–663

Latham, Silas B.: [Mackerel on the coast of Florida.] Bulletin, 1887 (1889), vol. VII, p. 3 4.

Massachusetts.

Babson, F. J.: [The Gloucester mackerel fishery of 1884.] Bulletin, 1885 (1885), vol. V, p. 343–346.

Elliott, James W.: [Mackerel, bluefish, codfish, etc., off the northeastern coast of Massachusetts.] Bulletin, 1886 (1887), vol. VI, p. 412.

Martin, S. J.: Notes on the mackerel fishery of 1881. Bulletin, 1881 (1882), vol. I, p. 132–133. F18–30

——— Movements and catch of mackerel. Bulletin, 1882 (1883), vol. II, p. 89–90. F18–78

——— The movements of schools of mackerel. Bulletin, 1883 (1883), vol. III, p. 295–296. F20–134

Nye, Willard: Mackerel abundant in Amherst River. Bulletin, 1882 (1883), vol. II, 272. F18–102

Smiley, Charles W.: The proposed use of steamers in the mackerel fishery. Bulletin, 1882 (1883), vol. II, p. 155–158. F12–354

New York.

Collins, J. W.: First arrival of mackerel in New York in the spring of 1882. Bulletin, 1881 (1882), vol. I, p. 402.

North Carolina.

U. S. Hydrographic Office: [Mackerel off Cape Fear.] Bulletin, 1886 (1887), vol. VI, p. 405.

Texas.

Labatt, Henry L.: [Spanish mackerel abundant in summer at Galveston.] Bulletin, 1886 (1887), vol. VI, p. 315.

Virginia.

McDonald, Marshall: Spanish mackerel—investigations at Cherrystone, Va., during the summer of 1881. Report, 1881 (1884), p. 1131–1133. F16–348

New England.

Collins, J. W.: A search for mackerel off Block Island, Montauk, and Sandy Hook, in November, 1883. Bulletin, 1884 (1884), vol. IV, p. 49–51. F18–213

Smith, Hugh McCormick: [New England mackerel fishery.] Report, 1894 (1896), p. 115–122.

Pacific Coast.

Collins, Joseph William: [Mackerel fishery of the Pacific coast of the United States.] Report, 1888–89 (1892), p. 15–17.

Gulf of St. Lawrence.

Collins, Joseph William: On the scarcity of mackerel in the Gulf of St. Lawrence. Bulletin, 1884 (1884), vol. IV, p. 427–430, 435–438. F18–359

MENHADEN.

General.

Abbe, W. A.: Proposed limitation of menhaden fishing to July 1 * * *. Bulletin, 1883 (1883), vol. III, p. 468–469. F18–192.

Babbit, John O.: The injurious effect of menhaden steamers upon the food fisheries. Bulletin, 1883 (1883), vol. III, p. 463–464. F18–189

Barker, E. L.: The incipiency of the menhaden oil business. Bulletin, 1883 (1883), vol. III, p. 456. F18–184

Church, Daniel T.: Why the size of mesh in menhaden seines should not be restricted. Bulletin, 1883 (1883), vol. III, p. 463. F18–188

Deblois, E. T.: The origin of the menhaden industry. Bulletin, 1881 (1882), vol. I, p. 46–51. F12–333

Friedlaender, Oscar O.: Notes on the menhaden industry. Bulletin, 1882 (1883), vol. II, p. 252; 1883 (1883), vol. III, p. 459–461; 1884 (1884), vol. IV, p. 47–48. F18–100, F18–186, F18–211

Goode, George Brown: The natural and economical history of the American menhaden. Report, 1877 (1879), 529 p., XXX pl. F12–236

Goode, G. Brown, and A. Howard Clark: The menhaden fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. V, p. 327–415.

Grant, Isaac H.: Movements of menhaden. Bulletin, 1883 (1883), vol. III, p. 470. F18–195

Hathaway, Walter E.: Effects of menhaden fishing upon the supply of menhaden and of the fishes that prey upon them. Bulletin, 1908 (1910), vol. XXVIII, p. 269–278. *Doc. 657 issued 1910.* 10–35137

Homergue, Louis C. d': Reasons for restricting the use of steamers and seines in the menhaden industry. Bulletin, 1883 (1883), vol. III, p. 456–458. F18–185

Kendall, William Converse: Effects of the menhaden and mackerel fisheries upon the fish supply. Bulletin, 1908 (1910), vol. XXVIII, p. 279–293. *Doc. 658, issued February, 1910.* 10–35152

King, W. Z.: [The menhaden season of 1884]. Bulletin, 1885 (1885), vol. V., p. 75.

Rathbun, Richard: [Menhaden fishery]. Report, 1894 (1896), p. 94–95.

Smith, Hugh McCormick: [Menhaden fishery]. Report, 1889-1891 (1893), p. 202-203; 1892 (1894), p. CLVII; 1894 (1896), p. 141; 1895 (1896), p. 108-112.

——— Notes on an investigation of the menhaden fishery in 1894, with special reference to food-fishes taken. Bulletin, 1895 (1896), vol. XV, p. 285-302. *Doc. 302 issued Feb. 28, 1896.* F12-400

Southwick, J. M. K.: The appearance of sharks, squid, menhaden, and frost-fish. Bulletin, 1885 (1885), vol. V, p. 358. F18-475

Stevenson, Charles Hugh: [The menhaden industry.] Report, 1902 (1904), p. 255-272.

Tanner, Zera Luther: Report on the work of the U. S. Fish commission steamer *Albatross* for the year ending December 31, 1883. Report, 1883 (1885), p. 117-236. *Doc. 96 issued Aug. 16, 1886.* F11-303

U. S. Commissioner of Fisheries: [The menhaden industry]. Report, 1900 (1901), p. 253; 1902 (1904), p. 476-477; 1914 (1915), p. 18-22.

Vail, David F.: Why the catching of menhaden with seines, etc., should be restricted. Bulletin, 1883 (1883), vol. III, p. 469. F18-194

Wharton, Joseph: Why menhaden seining should not be prohibited within two miles of the shore. Bulletin, 1883 (1883), vol. III, p. 462. F18-187

Connecticut.

Goode, George Brown: [The menhaden fisheries of Connecticut.] Report, 1877 (1879), p. 44, 85-87, 116.

Delaware.

Goode, George Brown: [The menhaden fisheries of Delaware.] Report, 1877 (1879), p. 41-42, 90, 116-117.

Florida.

Goode, George Brown: [The menhaden fisheries of Florida.] Report, 1877 (1879), p. 39.

Maine.

Goode, George Brown: [The menhaden fisheries of Maine.] Report, 1877 (1879), p. 48-50, 79-81, 114, 126-129.

Maryland.

Soper, Adelbert: [First appearance of menhaden.] Bulletin, 1886 (1887), vol. VI, p. 136.

Massachusetts.

Goode, George Brown: [The menhaden fisheries of Massachusetts.] Report, 1877 (1879), p. 45-48, 81-84, 115, 125-126.

New Jersey.

Goode, George Brown: [The menhaden fisheries of New Jersey.] Report, 1877 (1879), p. 42, 90, 116.

New York.

Conklin, B. F.: [The menhaden fishery at the east end of Long Island; 1793 to 1880.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. IV, p. 370-409.

Goode, George Brown: [The menhaden fisheries of New York.] Report, 1877 (1879), p. 42, 87-88, 116.

North Carolina.

Goode, George Brown: [The menhaden fisheries of North Carolina.] Report, 1877 (1879), p. 40-41, 91-92, 117.

Rhode Island.

Goode, George Brown: [The menhaden fisheries of Rhode Island.] Report, 1877 (1879), p. 44, 84-85, 115-116.

Southwick, J. M. K.: The appearance of menhaden. Bulletin, 1885 (1885), vol. V, p. 358. F18-475

South Carolina.

Mazyck, W. St. J.: [Scarcity of menhaden, sea-trout, and skip-jack off coast of South Carolina.] Bulletin, 1885 (1885), vol. V, p. 85-86.

Virginia.

Goode, George Brown: [The menhaden fisheries of Virginia.] Report, 1877 (1879), p. 41, 90-91, 117.

Polk, William R.: Experience of a menhaden oil manufacturer in Northumberland County, Va. Bulletin, 1883 (1883), vol. III, p. 455. F18–183

Middle Atlantic States.

Smith, Hugh McCormick: [Report on the menhaden fisheries of the Middle Atlantic States.] Bulletin, 1894 (1985), vol. XIV, p. 462–464.

U. S. Bureau of Fisheries: Statistics of the fisheries of the Middle Atlantic States for 1904. (Menhaden fisheries: p. 27–28, 53, 97–98, 121.) Report and special papers, 1905 (1906), 122 p. *Doc. 609 issued Feb. 19, 1907.* 7–35091

Atlantic Coast.

Greer, Rob Leon: The menhaden industry of the Atlantic coast. Appendix III, Report, 1914 (1915), 27 p., VII pl. *Doc. 811 issued Apr. 7, 1915.* F15–39

——— The menhaden industry of the Atlantic coast. (Selected bibliography of papers relating to fish fertilizers: p. 30.) 30 p., VII pl. *Doc. 811 reprinted with additions Oct. 18, 1917.* F17–263

MULLET.

General.

Earll, R. Edward: The mullet fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. IX, p. 553–582.

Florida.

Evermann, Barton Warren, and Tarleton Hoffman Bean: [Mullet fisheries of Indian River, Florida.] Report, 1896 (1897), p. 231–232.

Phillips, Barnet: Some notes on the mullet fisheries. Bulletin, 1884 (1884), vol. IV, p. 135–137. F13–89

Ravenel, W. de C.: Information bearing upon the artificial propagation of mullet. Bulletin, 1887 (1889), vol. VII, p. 197–202. F18–667

North Carolina.

Ravenel, W. de C.: Information bearing upon the artificial propagation of mullet. Bulletin, 1887 (1889), vol. VII, p. 197–202. F18–667

Gulf States.

U. S. Bureau of Fisheries: [Mullet fisheries of the Gulf States.] Report, 1899 (1900), p. 124; 1903 (1905), p. 439–440.

POMPANO: FLORIDA.

Evermann, Barton Warren, and Tarleton Hoffman Bean: [The pompano fisheries of Indian River, Florida.] Report, 1896 (1898), p. 232–233.

RED SNAPPER.

General.

Collins, Joseph William: [The red-snapper fishery.] Report, 1885 (1887), p. 276–297, X pl.

Latham, Silas B.: [Range of the red snapper.] Bulletin, 1887 (1889), vol. VII, p. 34.

Warren, Andrew F.: The red-snapper fisheries: their past, present, and future. Bulletin, 1897 (1898), vol. XVII, p. 331–335. *Doc. 390 issued Aug. 8, 1898.* F12–110

Florida.

Collins, Joseph William: Notes on the red-snapper fishery. (Based on information gathered from Capt. Silas Latham.) Bulletin, 1886 (1887), vol. VI, p. 299–300. F18–598

Stearns, Silas: [Notes on the red snapper.] Bulletin, 1885 (1885), vol. V, p. 92–93.

——— The red-snapper fishery and the Havana market fishery of Key West, Florida. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. X, p. 583–594.

Warren & Co.: [Where and how the red snapper is caught.] Bulletin, 1885 (1885), vol. V, p. 93–94.

Texas.

Stevenson, Charles Hugh: [Red-snapper fishery on the coast of Texas.] Report, 1889–1891 (1893), p. 383–384.

Gulf States.

U. S. Bureau of Fisheries: [Red-snapper fishery of the Gulf States.] Report, 1899 (1900), p. 125; 1903 (1905), p. 440–444.

Gulf of Mexico.

Collins, J. W.: The red snapper grounds in the Gulf of Mexico. Bulletin, 1885 (1885), vol. V, p. 145–146. F18–393

Smith, Hugh McCormick: [Snapper fishery on Campeche Bank, Gulf of Mexico.] Report, 1892 (1894), p. CLXXXIII–CLXXXIV; 1893 (1895), p. 68–70.

U. S. Commissioner of Fisheries: [Investigation of the red-snapper fisheries in the Gulf of Mexico.] Report, 1885 (1887), p. LXV–LXVII.

SABLEFISH.

Alaska.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Black cod: p. 61.) Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7–35263

Pacific coast.

Swan, James G.: Report on the black cod of the North Pacific Ocean. Bulletin. 1885 (1885), vol. V, p. 225–234. F18–413

U. S. Commissioner of Fisheries: [Value of black cod for food.] Report, 1883 (1885), p. LXVII.

——— [The black cod of the Pacific.] Report, 1885 (1887), p. LXVII.

SALMON.

General.

Atkins, Charles G.: On the salmon of eastern North America, and its artificial culture. Report, 1872 and 1873 (1874), p. 226–337. F15–99

U. S. Bureau of Fisheries: Miscellaneous notes and correspondence relative to salmon and trout. A. On the salmon in Maine, by Thomas Lincoln. B. On the stomachs of salmon and their contents, by James K. Thacher and Sidney I. Smith. C. On the silver-trout of Monadnock Lake, New Hampshire, by Thomas E. Hatch. D. On the edible qualities of the Sacramento salmon, by S. R. Throckmorton. E. On the salmon fisheries of the Sacramento River, by Livingston Stone. Report, 1872 and 1873 (1874), p. 369–379. F15–106

Alaska.

Ball, E. M.: [Copper River fishery.] *In* Alaska fisheries and fur industries in 1918. Appendix VII, Report, 1918 (1920), p. 31–35.

Bean, Tarleton Hoffman: Report on the salmon and salmon rivers of Alaska, with notes on the conditions, methods, and needs of the salmon fisheries. Bulletin, 1889 (1891), vol. IX, p. 165–208, IV, pl. XLV–LXXXVII (partly fold.). [First printed as House misc. doc. 211, 51st Cong.] *Doc. 159 issued June 11, 1891.* F12–147

Bower, Ward Taft: Alaska fisheries and fur industries. (Salmon fisheries.) Appendix VII, Report, 1918 (1920), p. 39–57; Appendix IX, Report, 1919 (1921), p. 38–52. F12–388

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries. (Salmon fisheries.) Appendix IX, Report, 1914 (1915), p. 80–116; Appendix III, Report, 1915 (1917), p. 35–51; Appendix II, Report, 1916 (1917), p. 38–56; Appendix II, Report, 1917 (1919), p. 28–43. F12–388

Bower, Ward Taft, and Harry C. Fassett: [Salmon fisheries: p. 80–116.] *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II. Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

Chamberlain, F. M.: Some observations on salmon and trout in Alaska. Report and special papers, 1906 (1908), 112 p., V pl., fold. map, diagrs. *Doc. 627 issued Dec. 18, 1907.* 7–35437

Chamberlain, Frederick M., and Ward Taft Bower: [Salmon industry: p. 38–56.] *In* Fishery and fur industries of Alaska in 1912, by B. W. Evermann. Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12–388

Cobb, J. N., and F. M. Chamberlain: [Salmon industry: p. 36–53.] *In* Alaska fisheries and fur industries in 1911, by B. W. Evermann. Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Report on inspection of salmon fisheries: p. 25–44.) Report and special papers, 1906 (1907), 70 p. *Doc. 618 issued May 16, 1907.* 7–35263

Evermann, B. W.: [Alaska salmon fishery.] Report, 1904 (1905), p. 87–102.

Fisher, William J.: Statement of the catch of several companies engaged in the salmon fisheries in Kodiak district, Alaska Territory, during the year 1883. Bulletin, 1884 (1884), vol. IV, p. 134. F18–247

Gilbert, C. H. and H. O'Malley: [Special investigation of salmon fishery in central and western Alaska.] *In* Alaska fisheries and fur industries in 1919, by W. T. Bower, Appendix IX, Report, 1919 (1921), p. 143.

Jones, E. L.: Report of Alaska investigations in 1914. 1915. 155 p., illus. F15–10

McDonald, Marshall: Report of the salmon fisheries of Alaska. Bulletin, 1892 (1893), vol. XII, 49 p., IX pl. (First printed as Senate doc. 192, 52d Cong., 1st sess. Misc. doc.) *Doc. 200 issued July 27, 1892.* F12–119

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Salmon: p. 12–44.) Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7–35263

——— The fisheries of Alaska in 1908. (Salmon fishery: p. 12–56.) Report and special papers, 1908, (1910), 78 p. *Doc. 645 issued Apr. 17, 1909.* 7–35263

——— The fisheries of Alaska in 1909. (Salmon fishery: p. 11–40.) Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20, 1910.* 7–35263

——— The fisheries of Alaska in 1910. (Salmon fishery: p. 11–40.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Moser, Jefferson F.: The salmon and salmon fisheries of Alaska. Report of operations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1898. Bulletin, 1898 (1899), vol. XVIII, p. 1–178, illus., folded charts, 63 pl. *Doc. 408 issued July 27, 1899.* F12–94

——— The salmon and salmon fisheries of Alaska. Report of the Alaskan salmon investigations of the U. S. Fish commission steamer *Albatross* in 1900 and 1901. Bulletin, 1901 (1902), vol. XXI, p. 173–398, 399–401, illus., fold., tables and charts, XLIV pls. *Doc. 510 issued Oct. 31, 1902.* F12–278

Rathbun, R.: [Salmon fisheries of Alaska.] Report, 1889–1891 (1893), p. 132–135.

——— [Salmon fisheries of Alaska, with act of 1889.] Report, 1888–89 (1892), p. LXXIV–LXXVI.

Smith, Hugh McCormick: [Salmon fisheries of Alaska.] Report, 1903 (1905), p. 79–80.

Townsend, C. H.: [Salmon fishery, Yukon River.] Report, 1898 (1899), p. CLXV.

U. S. Bureau of Fisheries: Explorations of the fishing grounds of Alaska, Washington Territory, and Oregon during 1888, by the U. S. Fish commission steamer *Albatross*, Lieut. Commander A. L. Tanner, U. S. N., commanding. Bulletin, 1888 (1890), vol. VIII, pl. 1–95, XII pl. partly fold. *Doc. 135 issued 1889.* F11–292

U. S. Commissioner of Fisheries: [Salmon fisheries of Alaska.] Report, 1907 (1909), p. 16–17.

——— [Alaska salmon service.] Report, 1912 (1914), p. 58–60; 1913 (1914), p. 33–36.

Ward, H. B.: [Special investigation of Copper River salmon fishery.] *In* Alaska fisheries and fur industries in 1919, by W. T. Bower, Appendix IX, Report, 1919 (1921), p. 119.

California.

Cobb, John Nathan: The salmon fisheries of the Pacific coast. (California: p. 18–21, 105–114.) Report and special papers, 1910 (1911). *Doc. 751 issued Nov. 25, 1911.* F11–393

San Francisco, Weekly Bulletin: [Canned-salmon trade.] Bulletin, 1886 (1887), vol. VI, p. 139.

Smiley, Charles W.: The influence of artificial propagation upon production illustrated by the salmon work of the Sacramento River, California. Bulletin, 1884 (1884), vol. IV, p. 201–202. F13–96

Connecticut.

[Connecticut River salmon.] Bulletin, 1886 (1887), vol. VI, p. 453.

Idaho.

Evermann, Barton Warren: A preliminary report upon salmon investigations in Idaho in 1894. Bulletin, 1895 (1896), vol. XV, p. 253–284. *Doc. 301 issued Feb. 20, 1896.* F12–245

Maine.

Atkins, Charles G.: [The sebago salmon fisheries of Maine in 1878]. Report, 1878 (1880), p. 775–787.

Evermann, Barton Warren: [The salmon fishery of Penobscot River and Bay, Maine, in 1900 and 1901.] Report, 1903 (1905), p. 110–114.

Hamlin, Augustus Choate: On the salmon of Maine. Report, 1872 and 1873 (1874), p. 338–356. F15–103

Smith, Hugh McCormick: The salmon fishery of Penobscot Bay and River in 1895 and 1896. Bulletin, 1897 (1898), vol. XVII, p. 113–124, illus., pl. 5. *Doc. 357 issued 1898.* F12–407

——— [Salmon fishery of Penobscot Bay and River.] Report, 1897 (1898), p. CXXX–CXXXI.

——— [Salmon of Penobscot basin.] Report, 1903 (1905), p. 81–82.

U. S. Commissioner of Fisheries: [Salmon fisheries of Penobscot River and Bay.] Report, 1900 (1901), p. 333–335.

Massachusetts.

Smith, Hugh McCormick: [Landlocked salmon in Massachusetts.] Report, 1903 (1905), p. 82–83.

New York.

Green, Seth: Salmon caught in Genesee River, New York. Bulletin, 1881 (1882), vol. I, p. 23–24. F18–12

Oregon.

Abernethy, A. S.: Salmon in the Clackamas River. Bulletin, 1886 (1887), vol. VI, p. 332. F18–603

Cobb, John Nathan: The salmon fisheries of the Pacific coast. (Oregon: p. 15–18, 92–105, 159–164.) Report and special papers, 1910 (1911). *Doc. 751 issued Nov. 25, 1911.* F11–393

Siglin, Zachary T.: [Salmon fisheries of southern Oregon in 1886.] Bulletin, 1886 (1887), vol. VI, p. 410.

Virginia.

Baird, Spencer Fullerton: [Atlantic salmon taken in the Potomac.] Bulletin, 1886 (1887), vol. VI, p. 453.

Washington.

Cobb, John Nathan: The salmon fisheries of the Pacific coast. (Washington: p. 179.) Report and special papers, 1910 (1911). *Doc. 751 issued Nov. 25, 1911.* F11–393

Rathbun, Richard: [Salmon fisheries in the contiguous waters of the State of Washington and British Columbia.] Report, 1899 (1900), p. 264–328.

New England.

Smith, Hugh McCormick: [Salmon fishery of New England.] Report, 1894 (1896), p. 128–129.

Pacific coast.

Alexander, Alvin B.: [Salmon fisheries of the Pacific coast.] Report, 1904 (1905), p. 141–162.

Cobb, John Nathan: The salmon fisheries of the Pacific coast. Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

——— Pacific salmon fisheries. Appendix III, Report, 1916 (1917), 255 p., incl. tables, XXIX pl. *Doc. 839 issued June 9, 1917.* F17–238

Collins, Joseph William: Report on the fisheries of the Pacific coast of the United States. Report, 1888–89 (1892), p. 3–269. *Doc. 178 issued Mar. 3, 1892.* F12–220

Holden, E. C.: The Columbia River salmon—a hatchery needed. Bulletin, 1884 (1884), vol. IV, p. 304. F18–321

Jordan, David Starr, and Charles H. Gilbert: The salmon fishing and canning interests of the Pacific coast. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. XII, p. 729–753.

McDonald, Marshall: The salmon fisheries of the Columbia River basin, together with a report upon physical and natural-history investigations in the region, by C. H. Gilbert and B. W. Evermann. Bulletin, 1894 (1895), vol. XIV, p. 153–207, pl. 13–25 (partly fold.). [First printed as Senate misc. doc. 200, 53d Cong., 2d sess.] *Doc. 290 issued Aug. 27, 1894.* F12–174

Salmon statistics of the Pacific coast for the seasons of 1884, 1885, and 1886. Bulletin, 1886 (1887), vol. VI, p. 399–400 incl. tables. F18–619

Smith, Hugh McCormick: [Pacific salmon fishery, with act of 1892.] Report, 1892 (1894), p. CLXXI–CLXXII.

——— Notes on a reconnoissance of the fisheries of the Pacific coast of the United States in 1894. Bulletin, 1894 (1895), vol. XIV, p. 223–228. *Doc. 293 issued May 21, 1895.* F11–351

Stone, Livingston: The salmon fisheries of the Columbia River. Report, 1875–76 (1878), p. 801–823. F16–70

——— Scarcity of salmon in the Little Spokane and other streams on the Pacific coast. Bulletin, 1883 (1883), vol. III, p. 476–477. F18–199

Wilcox, William A.: The commercial fisheries of the Pacific Coast States in 1904. (Salmon: p. 9–13.) Report and special papers, 1905 (1907), 74 p. *Doc. 612 issued Feb. 25, 1907.* 7–35100

——— [Salmon fisheries of the Pacific coast.] Report, 1893 (1895), p. 213–250, 284–295, 299–303; 1896 (1898), p. 577–589.

Lake Champlain.

Watson, W. C.: The salmon of Lake Champlain and its tributaries. Report, 1873–74 and 1874–75 (1876), p. 531–540. F16–26.

SARDINE.

General.

Earll, R. Edward: [Sardine industry.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V. vol, I, pt. VI, p. 489–524.

Earll, R. Edward, and Hugh M. Smith: The American sardine industry in 1886. Bulletin, 1887 (1889), vol. VII, p. 161–192, fold. map. *Doc. 123 issued June 20, 1889.* F11–252

Maine.

Hall, Ansley: The herring industry of the Passamaquoddy region. Report, 1896 (1898), p. 443–487, incl. tables. *Doc. 360 issued 1897.* F11–183

Pacific coast.

Wilcox, William A.: The commercial fisheries of the Pacific Coast States in 1904. (Sardines: p. 15.) Report and special papers, 1905 (1907), 74 p. *Doc. 612 issued Feb. 25, 1907.* 7–35100

Puget Sound.

Swan, James G.: Notes on the fisheries and the fishery industries of Puget Sound Bulletin, 1893 (1894), vol. XIII, p. 371–380, pl. 17. *Doc. 274 issued June 16, 1894.* F12–183

SCUP: NEW ENGLAND.

Baird, Spencer Fullerton: [Scup fishery of New England.] Report, 1871–72 (1873), p. 228–235.

Lyman, Theodore: [Scup fisheries.] Report, 1871–72 (1873), p. 112–116.

SHAD.

General.

Collins, Joseph William: Shad taken in mackerel gill-nets. Bulletin, 1882 (1883), vol. II, p. 95. F18–79

Rathbun, Richard: [Inquiry respecting the shad.] Report, 1896 (1898), p. 116.

Smiley, Charles Wesley: Notes on the shad season of 1884, with references to other species. Bulletin, 1884 (1884), vol. IV, p. 337–341. F18–327

Stevenson, Charles H.: The restricted inland range of shad due to artificial obstructions and its effect on natural reproduction. Bulletin, 1897 (1898), vol. XVII, p. 265–271. *Doc. 379 issued Aug. 8, 1898.* F12–110

U. S. Bureau of Fisheries: Notes on the shad season of 1884, with reference to other species. Bulletin, 1884 (1884), vol. IV, p. 337–341. F18–327

U. S. Commissioner of Fisheries: [Shad fisheries—Hudson River, Delaware River, and South Atlantic States.] Report, 1911 (1913), p. 35–37.

Worth, Stephen G.: [Commercial value of the shad.] Report, 1897 (1898), p. 138, also in Manual of fish-culture, rev. ed., 1900, p. 126.

Yarrow, Harry Crécy: Report of a reconnaissance of the shad rivers south of the Potomac. Report, 1872 and 1873 (1874), p. 396–402. F15–109

Connecticut.

Bean, Tarlton H.: [Young shad in the Housatonic River, Connecticut.] Bulletin, 1886 (1887), vol. VI, p. 315.

Chalker, Robert B.: Catch of shad in Connecticut for 1885, 1886, and 1887. Bulletin, 1886 (1887), vol. VI, p. 297–298, 439–441; 1887 (1889), vol. VII, p. 112. F18–597

Stevenson, Charles Hugh: [The shad fisheries of Connecticut in 1896.] Report, 1898 (1899), p. 250–258.

Delaware.

Jann, P. F.: Catch of shad in the Delaware River for 1885. Bulletin, 1886 (1887), vol. VI, p. 301. F18–599

Slack, James H.: Notes on the shad as observed in the Delaware River. Report for 1872 and 1873 (1874), p. 457–460. F16–65

Stevenson, Charles Hugh: [The shad fisheries of Delaware in 1896.] Report, 1898 (1899), p. 218–227.

Florida.

Cary, H. H.: The Saint John's River as a shad stream. Bulletin, 1885 (1885), vol. V, p. 422. F18–489

Dempsey, W.: Shad in the Saint John's River, Florida. Bulletin, 1886 (1887), vol. VI, p. 96. F18–547

Ferguson, Thomas B.: Extracts from a report of investigations of the shad fisheries and rivers south of Charleston, S. C., with a view to establishing stations for artificial propagation. Bulletin, 1884 (1884), vol. IV, p. 244–248. F18–299

Osborn John H.: Notes and suggestions concerning the Florida shad fishery. Bulletin, 1881 (1882), vol. I, p. 351. F20–138

——— Shad fishing on the St. John's River. Bulletin, 1882 (1883), vol. II, p. 132. F18–89

Shepard, Joseph: [Shad fishing on the Saint John's River, Florida.] Bulletin, 1886 (1887), vol. VI, p. 461.

Stevenson, Charles Hugh: [The shad fisheries of Florida in 1896.] Report, 1898 (1899), p. 127–133.

U. S. Commissioner of Fisheries: [Investigations of the shad fisheries of Florida.] Report 1884 (1886), p. XLI.

Way, D. L.: [The shad fisheries of Lake Monroe, Fla.] Bulletin, 1884 (1884), vol. IV, p. 318.

Georgia.

Stevenson, Charles Hugh: [The shad fisheries of Georgia in 1896.] Report, 1898 (1899), p. 133–140.

Yarrow, Harry Crécy: [The great decrease of the shad fishery of Georgia.] Report, 1872 and 1873 (1874), p. 396–398.

Maine.

Stevenson, Charles Hugh: [The shad fisheries of Maine in 1896.] Report, 1898 (1899), p. 263–269.

Maryland.

Babcock, William C.: Report of shad operations conducted at Fort Washington, Maryland . . . Report, 1883 (1885), p. 1035–1039; 1884 (1885), p. 189–192, plates.

Donnelly, Frank L.: [The shad fisheries near Havre de Grace, Md.] Bulletin, 1884 (1884), vol. IV, p. 319.

Stevenson, Charles Hugh: [The shad fisheries of Maryland in 1896.] Report, 1898 (1899), p. 192–217.

Massachusetts.

Blackford, Eugene Gilbert: [Shad in October.] Bulletin, 1885 (1885), vol. V, p. 101.

——— [Shad appearance.] Bulletin, 1886 (1887), vol. VI, p. 136.

Edwards, Vinal N.: [Shad, pollock, bill-fish, etc., at Cape Cod.] Bulletin, 1886 (1887), vol. VI, p. 454–455.

Stevenson, Charles Hugh: [The shad fisheries of Massachusetts in 1896.] Report, 1898 (1899), p. 260–263.

New Hampshire.

Laighton, Cedric: The capture of shad at Isles of Shoals, New Hampshire. Bulletin, 1881 (1882), vol. I, p. 421. F18–54

New York.

Blackford, E. G.: Catch of shad in the Hudson River for 1885. Bulletin, 1886 (1887), vol. VI, p. 294. F18–595

——— [Early shad.] Bulletin, 1886 (1887), vol. VI, p. 137.

Mather, Fred.: The shad fisheries of the Hudson. Bulletin, 1885 (1885), vol. V, p. 177–180. F18–398

New York States Agricultural Society, Transactions: [Shad on Staten Island in 1842.] Bulletin, 1886 (1887), vol. VI, p. 404–405.

Stevenson, Charles Hugh: [The shad fisheries of New York in 1896.] Report, 1898 (1899), p. 242–249.

North Carolina.

U. S. Commissioner of Fisheries: [North Carolina shad fishery.] Report, 1905 (1907), p. 40–41.

Worth, S. G.: [Shad in North Carolina.] Bulletin, 1886 (1887), vol. VI, p. 320.

Yarrow, Harry Crécy: Notes on the shad as observed at Beaufort Harbor, North Carolina and vicinity. Report, 1872 and 1873 (1874), p. 452–456. F15–112

Pennsylvania.

Fowler, Gilbert: [Shad fishing in the Susquehanna—what Mr. Gilbert Fowler knows about it.] Bulletin, 1881 (1882), vol. I, p. 367–368.

Osterhout, P. M.: [Shad—How they were caught in ye olden days—The fishery companies—The reason shad do not now inhabit the upper waters of the Susquehanna.] Bulletin, 1881 (1882), vol. I, p. 364–366.

Stevenson, Charles Hugh: [The shad fisheries of Pennsylvania in 1896.] Report, 1898, p. 223–227.

Townsend, Charles Haskins: [Shad fisheries of Pennsylvania.] Report, 1901 (1902), p. 150.

Willis, H.: Shad fisheries of the Susquehanna River fifty-six years ago. Bulletin, 1881 (1882), vol. I, p. 261–263. F18–49

Wright, Harrison: On the early shad of the north branch of the Susquehanna River. Report, 1881 (1884), p. 619–642. F16–334

Wyoming Historical and Geological Society, Wilkesbarre, Pa.: Report of a committee of the Wyoming historical and geological society on the early shad fisheries of the north branch of the Susquehanna River. Bulletin, 1881 (1882), vol. I, p. 352–379. F11–218

Rhode Island.

Cory, E. J., and Vinal N. Edwards: [Shad caught in November.] Bulletin, 1886 (1887), vol. VI, p. 455.

Stevenson, Charles Hugh: [The shad fisheries of Rhode Island in 1896.] Report, 1898 (1899), p. 258–260.

South Carolina.

Baird, Spencer F.: [Investigations of the shad fisheries of South Carolina in 1884.] Report, 1884 (1886), p. XLI.

Ferguson, Thomas B.: Extracts from a report of investigations of the shad fisheries and rivers south of Charleston, S. C., with a view to establishing stations for artificial propagation. Bulletin, 1884 (1884), vol. IV, p. 244–248. F18–299

Stevenson, Charles Hugh: [The shad fisheries of South Carolina in 1896.] Report, 1898 (1899), p. 140–154.

Wood, William Maxwell: Report of an examination of the shad fisheries in Georgetown, S. C. Bulletin, 1884 (1884), vol. IV, p. 140–141. F18–249

——— Reconnaissance of the shad fisheries of Winyaw Bay and its tributaries, by the steamer *Fish Hawk*. Bulletin, 1884 (1884), vol. IV, p. 242–243. F18–298

Virginia.

Stevenson, Charles Hugh: [The shad fisheries of Virginia in 1896.] Report, 1898 (1899), p. 176–192.

Atlantic coast.

Smith, Hugh McCormick: [Shad fisheries of the Atlantic coast.] Report, 1896 (1898), p. 130; 1897 (1898), p. CXXV–CXXX.

Stevenson, Charles Hugh: The shad fisheries of the Atlantic coast of the United States. Report, 1898 (1899), p. 101–269. *Doc. 403 issued Mar. 17, 1899.* F11–115

Middle Atlantic States.

Smith, Hugh McCormick: [Shad fisheries of the Middle Atlantic States.] Bulletin, 1894 (1895), vol. XIV, p. 450–452.

Pacific coast.

Smith, Hugh McCormick: [Shad fishery of the Pacific coast.] Bulletin, 1895 (1896), vol. XV, p. 416–427.

Chesapeake Bay.

U. S. Commissioner of Fisheries: [Shad and alewife fisheries of Chesapeake Bay.] Report, 1910 (1911), p. 27; 1913 (1914), p. 65–66.

Gulf of Mexico.

U. S. Bureau of Fisheries: Letters referring to the presence of shad in the river tributary to the Gulf of Mexico. [From John T. Knight, Isaac W. Pollard, George W. Lawrence, Will E. Turner, and Holmes A. Pattison.] Report, 1872 and 1873 (1874), p. 391–395. F16–64

Ohio River.

Applegate, J. P.: [Shad in the Ohio River.] Bulletin, 1886 (1887), vol. VI, p. 141.

Potomac River.

Chapman, Pearson: Habits of the shad and herring as they appear in the Potomac River to one who has watched them for fifty years. Bulletin, 1884 (1884), vol. IV, p. 61–64. F13–81

Harris, Gwynn: Report upon the shad and herring fisheries of the Potomac River for 1882–1886. Bulletin, 1883 (1883), vol. III, p. 477; 1884 (1884), vol. IV, p. 13, 221; 1885 (1885), vol. V, p. 192; 1886 (1887), vol. VI, p. 202. F18–202

Lennurt, J. T.: Catch of spawning shad in the Potomac, above Georgetown. Bulletin, 1883 (1883), vol. III, p. 440. F18–171

Smith, Hugh McCormick: [Shad fisheries of the Potomac.] Report, 1889–1891 (1893), p. 182.

Waller, Withers: [Shad in the Potomac, 1854 to 1881.] Bulletin, 1884 (1884), vol. IV, p. 361–362.

Mississippi River.

McDowell, W. W.: [Shad in the Mississippi at Memphis.] Bulletin, 1886 (1887), vol. VI, p. 315–316.

SHARK: NANTUCKET.

Gardner, Albert A.: [Shark fishing at Nantucket.] Bulletin, 1886 (1887), vol. VI, p. 460–461.

SPOT.

Collins, Joseph William: [The spot fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. VII, p. 533–538.

SQUETEAGUE.

Collins, Joseph William: [The squeteague or "trout" fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. VII, p. 527–533.

STURGEON.

General.

Hovey, H. C.: The sturgeon fishery. Bulletin, 1884 (1884), vol. IV, p. 346–348. F13–114

Rathbun, Richard: [Report upon the inquiry respecting the sturgeon fisheries.] Report, 1888–89 (1892), p. LXXXIX–XCIII.

Ryder, John Adam: The sturgeons and sturgeon industries of the eastern coast of the United States, with an account of experiments bearing upon sturgeon culture. ["Literature relating to the sturgeon:" p. 279–280.] Bulletin, 1888 (1890), vol. VIII, p. 231–328, pl. XXXVI–LIX. *Doc. 143 issued Mar. 25, 1891.* F11–324

U. S. Commissioner of Fisheries: [Passing of the sturgeon.] Report, 1913 (1914), p. 66–67.

Delaware.

Cobb, John Nathan: The sturgeon fishery of Delaware River and Bay. Report, 1899 (1900), p. 369-380, pls. *Doc. 429 issued Aug. 25, 1900.* F11–110

U. S. Commissioner of Fisheries: [Sturgeon fishery of the Delaware River.] Report, 1914 (1915), p. 23.

Florida.

Townsend, Charles Haskins: [The sturgeon fishery of Florida.] Report, 1901 (1902), p. 155 incl. tables.

U. S. Commissioner of Fisheries: [Sturgeon fishery in Florida.] Report, 1915 (1917), p. 76.

Pacific coast.

Smith, Hugh McCormick: [Sturgeon and sturgeon fishery.] Bulletin, 1894 (1895), vol. XIV, p. 275–279.

Columbia River.

Wilcox, William A.: [Sturgeon fishery of the Columbia River.] Report, 1893 (1895), p. 250–253.

SWORDFISH.

General.

Goode, George Brown: Materials for a history of the swordfishes. Report, 1880 (1883), p. 289–294, XXIV pl. *Doc. 51 issued June 3, 1883.* F16–284

——— The swordfish fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. IV, p. 315–326.

U. S. Commissioner of Fisheries: [Swordfish fishery.] Report, 1915 (1917), p. 62–63.

New England.

Clark, A. Howard: Notes on the New England fishery for the swordfish during the season of 1884. Report, 1884 (1886), p. 233–239. F17–186

TILEFISH.

Bumpus, Herman Carey: The reappearance of the tilefish. Bulletin, 1898 (1899), vol. XVIII, p. 321–333. *Doc. 416 issued Oct. 30, 1899.* F12–32

Collins, Joseph William: Report upon a cruise made to the tilefish ground in the smack *Josie Reeves*, September, 1882. Bulletin, 1882 (1883), vol. II, p. 301-310. F18–107

——— [Tilefish fishery.] Report, 1886 (1889), p. 702.

Smith, Hugh McCormick: [Tilefish fishery.] Report, 1903 (1905), p. 84–85.

U. S. Commissioner of Fisheries: [Tilefish fisheries.] Report, 1881 (1884), p. XL.

——— [Investigation of the alleged destruction of the tilefish.] Report 1882 (1884), p. LII.

TROUT: ALASKA.

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries in 1914. (Trout fishery: p. 64–65.) Appendix IX, Report, 1914 (1915), 89 p. *Doc. 819 issued Sept. 23, 1915.* F12–388

Bower, Ward Taft, and Clifford H. Fassett: [Noteworthy catch of Dolly Varden trout: p. 65–66.] *In* Alaska fisheries and fur industries in 1913, by Barton Warren Evermann. Appendix II, Report, 1913 (1914). *Doc. 797 issued Aug. 29, 1914.* F12–388

Chamberlain, Frederick M., and Ward Taft Bower: [Trout fishery: p. 71–72.] *In* Fishery and fur industries of Alaska in 1912, by B. W. Evermann. Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12–388

Cobb, John Nathan, and Frederick M. Chamberlain: [The trout fishery: p. 63-64.] *In* Alaska fisheries and fur industries in 1911, by Barton Warren Evermann. Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

TUNA: CALIFORNIA.

Smith, Hugh McCormick: [The tuna fishery of California.] Report, 1914 (1915), p. 35–37.

WHITEFISH.

Evermann, Barton Warren, and Hugh McCormick Smith: The whitefishes of North America. Report, 1894 (1896), p. 283–324, illus., pls. *Doc. 323 issued Feb. 6, 1894.* F11–189

Howell, D. Y.: Injuries caused by gill nets to whitefish. Bulletin, 1885 (1885), vol. V, p. 324. F18–742

McQueen, Alexander: [Large whitefish.] Bulletin, 1886 (1887), vol. VI, p. 138.

U. S. Bureau of Fisheries: Miscellaneous notes and correspondence relative to the whitefish. A. The whitefish of the Great Lakes [letters from George Barnston, John W. Kerr, Peter Kiel]. B. The whitefish of eastern Maine and New Brunswick, by Charles Lanman. C. New species of Argyrosomus and Coregonus, by James W. Milner. Report, 1872 and 1873 (1874), p. 79–89. F15–92

WHITING.

Nye, Willard: [Appearance of whiting or frost-fish.] Bulletin, 1886 (1887), vol. VI, p. 137.

CANADA.

ALEWIFE.

Lanman, Charles: The shad and gaspereau or alewife of New Brunswick and Nova Scotia. Report, 1872–73 (1874), p. 461–462. F16–66

HERRING.

General.

Joncas, L. Z.: The fisheries of Canada. Bulletin, 1893 (1894), vol. XIII, p. 341–348. *Doc. 270 issued June 28, 1894.* F12–183

Labrador.

Stearns, W. A.: [Herring.] Bulletin, 1885 (1885), vol. V, p. 17–19.

Newfoundland.

U. S. Bureau of Fisheries: [Newfoundland herring fishery: p. 50–51.] Report, 1911 (1913).

Wilcox, W. A.: Notes on the frozen herring trade with Newfoundland and the Bay of Fundy during the winter of 1886–87. Bulletin, 1887 (1889), vol. VII, p. 71–73. F18–655

MACKEREL.

General.

Joncas, L. Z.: The fisheries of Canada. Bulletin, 1893 (1894), vol. XIII, p. 341–348. *Doc. 270 issued June 28, 1894.* F12–183

Labrador.

Stearns, W. A.: [The Labrador mackerel fisheries.] Bulletin, 1885 (1885), vol. V, p. 25–26.

SALMON.

Habersham, William Ney A.: Notes on the use of the male salmon hook and the run of 1883. Bulletin, 1884 (1884), vol. IV, p. 52. F18–215

Witcher, W. F.: [Decline of the Canadian salmom fisheries.] Bulletin, 1884 (1884), vol. IV, p. 363.

SHAD.

Lanman, Charles: The shad and gaspereau or alewife of New Brunswick and Nova Scotia. Report, 1872 and 1873 (1874), p. 461–462. F16–66

SOUTH AMERICA: SHAD.

Fishing for shad in South American waters. Bulletin, 1882 (1883), vol. II, p. 158. F18–92

EUROPE.

BRISLING: NORWAY.

Friele, M.: [The Norwegian brisling fishery.] Report, 1877 (1879), p. 730–731.

CAPELAN: NORWAY.

Sars, George Ossian: Report submitted to the Department of the Interior on the practical and scientific investigations of the Finmark capelan-fisheries, made during the spring of the year 1879. (Tr. by Herman Jacobson.) Report, 1880 (1883), p. 167–187. F16–299

CARP.

Austria.

The **carp** trade in Austria. Bulletin, 1884 (1884), vol. IV, p. 308.

Germany.

The **carp** fisheries in the Peitz Lakes. Report, 1878 (1880), p. 675-678. F16-176

EEL: SWEDEN.

Lundberg, Rudolph: Eel-fishing with so-called "hommer" (a species of fish-pot) on the Baltic coast of Sweden and in the Sound. Report, 1883 (1885), p. 415-430, pl., illus. F17-33

——— [Eel fisheries of Sweden.] Report, 1884 (1886), p. 380-384.

FLOUNDERS: SWEDEN.

Lundberg, Rudolph: [Flounder fisheries of Sweden.] Report, 1884 (1886), p. 384-386.

HALIBUT.

Iceland.

Collins, J. W.: On the abundance of halibut near Iceland. Bulletin, 1884 (1884), vol. IV, p. 463-464. F18-362

——— The Icelandic halibut fishery: An account of the voyages of three Gloucester schooners to the fishing grounds near the north coast of Iceland. Report, 1884 (1886), p. 289-300. F17-128

Garde, Aug.: [Halibut fisheries of Iceland.] Report, 1884 (1886), p. 301.

Thorsteinson, Árni Bjarnason: American halibut-fisheries near Iceland. Bulletin, 1885 (1885), vol. V, p. 429-432. F18-496

U. S. Commissioner of Fisheries: [Iceland halibut fishery.] Report, 1884 (1886), p. XL-XLI; 1885 (1887), p. LI-LII.

Norway.

Juel, Niels: [Norwegian halibut fisheries.] Bulletin, 1885 (1885), vol. V, p. 89-90.

HERRING.

Germany.

Dantziger: The first five years of the Emden joint-stock herring-fishery association. Report, 1877 (1879), p. [751]-776. F16-115

Great Britain.

Carr, T. F. Robertson: Notes on the Scotch herring fisheries. Bulletin, 1884 (1884), vol. IV, p. 60, 431. F18-221, F18-356

Collins, J. W.: Notes on the English herring and mackerel fisheries, and the methods of curing. Bulletin, 1885 (1885), vol. V, p. 40. F18-375

The **Scotch** herring fisheries in 1882 [and 1883]. Bulletin, 1882 (1883), vol. II, p. 117-118; 1883 (1884), vol. IV, p. 472. F18-87

Simonsen, Carl: The herring fisheries near the Isle of Man. Bulletin, 1886 (1887), vol. VI, p. 152-155. F18-563

Smith, Hugh McCormick: Observations on the herring fisheries of England, Scotland, and Holland. Bulletin, 1902 (1904), vol. XXII, p. 1-16, illus., 2 pl, *Doc. 511 issued Feb. 4, 1903.* F12-55

Southwell, Thomas: Notes on the English herring fishery of 1882. Bulletin, 1883 (1883), vol. III, p. 465-466. F12-390

——— [Note on the herring fisheries of Great Britain.] Bulletin, 1885 (1885), vol. V, p. 87.

Iceland.

Finn, W.: The Iceland herring fisheries. Report, 1879 (1882), p. 493-496. F17-5

Trolle, C.: [The Iceland herring fisheries.] Report, 1880 (1883), p. 84-87.

Netherlands.

Smith, Hugh McCormick: Observations on the herring fisheries of England, Scotland, and Holland. Bulletin, 1902 (1904), vol. XXII, p. 1-16, illus., 2 pl. *Doc. 511 issued Feb. 4, 1903.* F12-55

Norway.

Boeck, Axel, i. e. Jonas Axel: The Norwegian herring-fisheries. Report, 1873–74 and 1874–75 (1876), p. 97-122. F16–7

Buch, Sophus Andreas: Spawning of spring herring near Norway. Bulletin, 1885 (1885), vol. V, p. 297–300. F18–447

Friele, M.: An account of the fisheries of Norway in 1877. Report, 1877 (1879), p. 707–739. F16–113

Jensen, Olaf Scheveland: Report on the practical and scientific investigations of the spring herring fisheries during the year 1880, submitted to the Department of the interior. Report, 1880 (1883), p. 127–161. F16–288

New contributions to the herring question. The dispute between Axel Boeck and Ossian Sars regarding the Norwegian summer-herring; Sars' recent observations and his theory on the migrations of the herrings. Report, 1873–74 and 1874–75 (1876), p. 195–211. F16–12

[The **Norwegian** herring fisheries in 1883]. Report, 1883 (1885), p. 366–367.

Sars, George Ossian: [Herring fisheries of the Loffoden Islands.] Report, 1877 (1879), p. 637–661.

Strõm, Boye: [The herring fisheries of the Loffoden Islands and in the district of Vesteraalen]. Report, 1884 (1886), p. 338–343.

Sweden.

Ljungman, Axel Vilhelm: Preliminary report for 1873–74 on the herring and herring-fisheries on the west coast of Sweden. Report, 1873–74 and 1874–75 (1876), p. 125–168. F16–8

——— [Brief review of our present knowledge of the mode of life and the migration of the herring, and their physical and biological causes.] Report, 1878 (1880), p. 160–220.

——— The great Bohuslän herring fisheries. Report, 1878 (1880), p. 221–239. F16–158

——— Contributions toward solving the question of the secular periodicity of the great herring fisheries. Report, 1879 (1882), p. 497–503. F17–6

——— Contributions toward a more correct knowledge of the herring's mode of life. Report, 1879 (1882), p. 505–513. F17–7

——— The Bohus-län sea fisheries and their future. Report, 1880 (1883), p. 89–98. F16–290

——— What should be done by the government with regard to the great Bohus-län herring fisheries. A memorial addressed to the Council of state and the head of the Royal civil department [of Sweden]. Report, 1880 (1883), p. 99–126. F16–291

——— The great herring fisheries considered from an economical point of view. Report, 1883 (1885), p. 341–357. F17–30

——— Special results of the investigations relating to the herring and herring fisheries on the west coast of Sweden made during the years 1873–1883. Report, 1883 (1885), p. 729–745. F17–34

——— The future of the herring fisheries on the coast of Bohus-län. Report, 1884 (1886), p. 399–409. F17–132

Martin, S. J.: The American purse-seine successful in the herring fisheries of Sweden. Bulletin, 1883 (1883), vol. III, p. 161.

Yhlen, Gerhard von: [The herring fishery of the Län Göteborg and Bohus in the year 1877.] Report, 1877 (1879), p. 742–749.

Baltic.

Widegren, Hjalmar: [The herring fishery of the Baltic.] Report, 1878 (1880), p. 124–135.

White Sea.

Schultz, Alexander: [The herring fisheries in the White Sea.] Report, 1873–74 and 1874–75 (1876), p. 37–40.

MACKEREL.

Great Britain.

Green, William Spotswood: Notes on the Irish mackerel fisheries. Bulletin, 1893 (1894), vol. XIII, p. 357–360, pl. 13–16. *Doc. 272 issued June 16, 1894.* F12–183

Norway.

Friele, M.: [Mackerel fishery in Norway in 1877.] Report, 1877 (1879), p. 731–733.

Sars, George Ossian: [Mackerel fishery of Norway.] Report, 1877 (1879), p. 667–674.

Sweden.

Yhlen, Gerhard von: Report of the sea-fisheries of the Län Göteborg and Bohus in the year 1877. Report, 1877 (1879), p. 741–750. F16–114

Baltic.

Möbius, Karl August: [Scientific investigations upon the fishes profitable to the fisheries.] Report, 1879 (1882), p. 534–548.

SALMON.

France.

Jerrell, H. P.: Concerning the salmon fisheries of Bretagne, France, and the need of fish-ways and restrictive legislation. Bulletin, 1884 (1884), vol. IV, p. 185–186. F18–276

Germany.

Benecke, B.: Observations on salmon in German Rivers. Bulletin, 1886 (1887), vol. VI, p. 119–122. F18–556

Hoek, Paulus Peronius Cato: Propagation and protection of the Rhine salmon. Bulletin, 1908 (1910), vol. XXVIII, p. 817–829, diags. *Doc. 682 issued April, 1910.* 10–35437

Sweden.

Lundberg, Rudolph: [Salmon fisheries of Sweden.] Report, 1884 (1886), p. 386–387.

Sweden, Statens Fiskeriadministration: Improvement in the salmon fisheries of Sweden. Extract from the Report of the Royal intendant of fisheries. Report, 1872 and 1873 (1874), p. 166-167. F15–95

Trybom, Filip: Salmon fisheries of Halland, Sweden, especially in the River Viskan. Bulletin, 1886 (1887), vol. VI, p. 104–105. F18–549

Widegren, Hjalmar: [Salmon fisheries of Sweden.] Report, 1873–74 and 1874–75 (1876), p. 32.

Baltic.

Fiedler: The migrations of salmon (*Salmo salar L.*) in the Baltic. Bulletin, 1885 (1885), vol. V, p. 185–188. F18–401

White Sea.

Schultz, Alexander: [Salmon fisheries of the White Sea.] Report, 1873–74 and 1874–75 (1876), p. 40–43.

SARDINE.

Denmark.

The **sardine** fisheries. Report, 1880 (1883), p. 163–165. F16–298

France.

France, Moniteur de la Pisciculture: [Sardine fisheries in France.] Bulletin, 1886 (1887), vol. VI, p. 408–409.

SHARK.

Iceland.

Garde, Aug.: [Shark fisheries of Iceland.] Report, 1884 (1886), p. 305.

The **Iceland** shark-fisheries. Bulletin, 1885 (1885), vol. V, p. 301–304. F18–448

Norway.

[The **Norwegian** shark fisheries in 1883.] Report, 1883 (1885), p. 362.

Ström, Boye: [Norwegian shark fisheries in 1880.] Report, 1884 (1886), p. 349; 1885 (1887), p. 219; 1886 (1889), p. 1059.

SPRAT: SWEDEN.

Yhlen, Gerhard von: [Sprat fishery in the Län of Göteborg and Bohus in the year 1877.] Report, 1877 (1879), p. 749.

JAPAN: CARP.

Japan. Bureau of Agriculture: [Carp fisheries of Japan.] Bulletin, 1893 (1894), vol. XIII, p. 428.

HAWAIIAN ISLANDS.

MULLET.

Moser, Jefferson F.: [Mullet fishery of the Hawaiian Islands.] Report, 1897 (1898), p. CLXIX–CLXX.

SHARK.

Cobb, John Nathan: [Shark fisheries of the Hawaiian Islands.] Report, 1901 (1902), p. 421–422.

FISHERY PRODUCTS.

PRESERVATION OF PRODUCTS.

BAIT.

Collins, Joseph William: Inauguration of the frozen-herring trade. Bulletin, 1884 (1884), vol. IV, p. 81–83. F13–85

——— Some reasons why the fishermen of Nova Scotia prefer to use salt clams (*Mya arenaria*) for bait in the bank hand-line cod fisheries. Bulletin, 1887 (1889), vol. VII, p. 425–428 incl. tables. F18–679

Smith, Hugh McCormick: [Method of preparing bait used in the French sardine fishery.] Bulletin, 1901 (1902), vol. XXI, p. 8–10.

Waage, Peter: Preservation of bait. Bulletin, 1885 (1885), vol. V, p. 200-201. F18–407

COLLAGEN.

Cobb, J. N.: Pacific cod fisheries. (Glue from codfish skins: p. 71.) Report, 1915 (1917), 111 p. *Doc. 830 issued Oct. 23, 1916.* F16–191

Green, Erik H.: The chemical composition of the subdermal connective tissue of the ocean sunfish. Bulletin, 1899 (1901), vol. XIX, p. 321–324. *Doc. 449 issued Aug. 31, 1900.* F12–84

Green, Erik H., and Ralph Winfred Tower: The organic constituents of the scales of fish. Bulletin, 1901 (1902), vol. XXI, p. 97–102. *Doc. 496 issued May 26, 1902.* F12–272

White, George F.: Fish isinglass and glue. Appendix IV, Report, 1917 (1919). *Doc. 852 issued Aug. 27, 1917.* F17–249

FERTILIZER.

Atwater, Wilber Olin: Report of the analysis of a sample of fish guano made from salmon offal, by Mr. Joseph Spratt, of Victoria, British Columbia. Bulletin, 1884 (1884), vol. IV, p. 238 F13–103

——— [Menhaden and other fish and their products as related to agriculture.] Report, 1887 (1891), p. 194–267.

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries in 1914. (Fertilizer from fish products: p. 62–64.] Appendix IX, Report, 1914 (1915), p. 1–89. *Doc. 819 issued Sept. 23, 1915.* F12–388

Bower, Ward Taft and H. C. Fassett: [Fertilizer from canning waste: p. 134-135]. *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II, Report, 1913, (1914), p. 37–139. F12–388

Cobb, J. N.: The salmon fisheries of the Pacific coast. (Refuse from canneries used for fertilizer: p. 66–67.) Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

——— Pacific cod fisheries. (Refuse for fertilizer: p. 71.) Appendix IV, Report, 1915 (1917), 111 p. *Doc. 830 issued Oct. 23, 1916.* F16–191

Cobb, J. N., and H. M. Kutchin: The fisheries of Alaska in 1906. (Utilization of food-fishes for fertilizer: p. 54–56.) Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued May 16, 1907.* 7–35263

Gallup, B. Frank: Catching dogfish for oil and guano. Bulletin, 1882 (1883), vol. II, p. 246. F18–99

Greer, Rob Leon: The menhaden industry of the Atlantic coast. Appendix III, Report, 1914 (1915), 27 p., 7 pl. *Doc. 811, issued Apr. 7, 1915.* F15–39

——— The menhaden industry of the Atlantic coast. (Selected bibliography of papers relating to fish fertilizers: p. 30.) 30 p., VII pl. *Doc. 811 reprinted with additions Oct. 18, 1917.* F17–263

Lawrence-Hamilton, J.: [Utilization of waste fish and fish products.] Bulletin, 1893 (1894), vol. XIII, p. 305–306.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1909. (The fertilizer question: p. 49–50.) Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20, 1910.* 7–35263

——— The fisheries of Alaska in 1910. (The fertilizer question: p. 47–50.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Moser, Jefferson F.: [Guano from herring, in Alaska.] Bulletin, 1898 (1899), vol. XVIII, p. 122–123.

Smiley, Charles Wesley: The extent of the use of fish guano as fertilizer. Report, 1881 (1884), p. 663–695. F16–336

Stevenson, Charles Hugh: Aquatic products in art and industries. Fish oils, fats, and waxes. Fertilizers from aquatic products. Report, 1902 (1904), p. 177–279, pls. *Doc. 536 issued Sept. 26, 1903.* F11–3

[Use of fish refuse as manure.] Bulletin, 1886 (1887), vol. VI, p. 317.

Wilcox, William A.: [Manufacture of guano at Killisnor, Alaska.] Report, 1893 (1895), p. 303.

GLUE.

Clark, A. Howard: [Utilization of fish skins for glue.] *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. IV, p. 149–150.

White, George F.: Fish isinglass and glue. Appendix IV, Report, 1917 (1919), 15 p. *Doc. 852 issued Aug. 27, 1917.* F17–249

ICHTHYLEPIDIN.

Green, Erik H., and Ralph Winfred Tower: The organic constituents of the scales of fish. Bulletin, 1901 (1902), vol. XXI, p. 97–102. *Doc. 496 issued May 26, 1902.* F12–272

ISINGLASS.

Anderssen, Joakim: [Making isinglass from fish-maws.] Report, 1878 (1880), p. 70.

Knudsen, Henrik: Some facts concerning isinglass. Bulletin, 1885 (1885), vol. V, p. 295–297. F18–446

Schultz, Alexander: [Manufacture of isinglass.] Report, 1873–74 and 1874–75 (1876), p. 86–87.

Smith, Hugh McCormick: [Utilization of weakfish sounds.] Report, 1896 (1898), p. 144.

White, George F.: Fish isinglass and glue. Appendix IV, Report, 1917 (1919), 15 p. *Doc. 852 issued Aug. 27, 1917.* F17–249

OIL.

Atwood, Nathaniel E.: Unexplained variations in the yield of oil from cod livers. Bulletin, 1883 (1883), vol. III, p. 431–432. F18–165

Baird, Spencer Fullerton: [Fish as oil.] Report, 1886 (1889), p. 149–150.

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries in 1914. (Oil from fishery products: p. 62–64.) Appendix IX, Report, 1914 (1915), 89 p. *Doc. 819 issued Sept. 23, 1915.* F12–388

Bower, Ward Taft, and Clifford H. Fassett: [Oil from canning waste: p. 134–135.] *In* Alaska fisheries and fur industries in 1913, by B. W. Evermann. Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

Cobb, John Nathan: [Oil from the refuse of the sturgeon.] Report, 1899 (1900), p. 377.

——— Pacific cod fisheries. (Cod liver oil: p. 70–71.) Report, 1915 (1917), 111 p. *Doc. 830 issued Oct. 23, 1916.* F16–191

De Blois, E. T.: The origin of the menhaden industry. Bulletin, 1881 (1882), vol. I, p. 46–51. F12–333

Friedlaender, Oscar O.: [Yield of menhaden oil per 1,000 fish.] Bulletin, 1883 (1883), vol. III, p. 459.

Friele, M.: [Preparation of the oil from the cod.] Report, 1877 (1879), p. 717–718.

Gallup, B. Frank: Catching dogfish for oil and guano. Bulletin, 1882 (1883), vol. II, p. 246. F18–99

——— [Oil and guano from drumfish.] Bulletin, 1883 (1885), vol. III, p. 462.

Goode, George Brown: The natural and economical history of the American menhaden. Report, 1877 (1879), 529 p., pl. I–XXXI. F12–236

Goode, G. Brown, and A. Howard Clark: [Methods of manufacturing menhaden oil.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. V, p. 343–345.

——— [History of the menhaden oil industry.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. V, p. 364–370.

Greer, Rob Leon: The menhaden industry of the Atlantic coast. Appendix III, Report, 1914 (1915), 27 p., VII pls. (incl. front.). *Doc. 811 issued Apr. 7, 1915.* F15-39

——— The menhaden industry of the Atlantic coast. 30 p., VII pl. *Doc. 811 reprinted with additions Oct. 18, 1917.* F17-263

The Iceland shark fisheries. Bulletin, 1885 (1885), vol. V, p. 301-304. F18-448

Jordan, David Starr, and Charles H. Gilbert: [Making oil from salmon heads.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. XII, p. 750.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1910. (Use of herring in the manufacture of oil: p. 47–50.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.*

Moser, Jefferson F.: [Extracting oil from herring in Alaska.] Bulletin, 1898 (1899), vol. XVIII, p. 122–123.

Schieffelin, W. H., & Co.: Unexplained variations in the yield of oil from cod livers Bulletin, 1883 (1883), vol. III, p. 431. F18–164

Schultz, Alexander: [Oil from sturgeon, herring, and lampreys.] Report, 1873–74 and 1874–75 (1876), p. 89–90.

Smith, Hugh McCormick: [Menhaden for oil and guano.] Bulletin, 1895 (1896), vol. XV, p. 285-290.

Sparks, George L.: [Porpoise oil.] Bulletin, 1885 (1885), vol. V, p. 415.

Stearns, Winfrid Alden: [Cod liver oil.] Bulletin, 1885 (1885), vol. V, p. 12.

Stevenson, Charles Hugh: Aquatic products in arts and industries. Fish oils, fats, and waxes. Fertilizers from aquatic products. Report, 1902 (1904), p. 177-279, pls. *Doc. 536 issued Sept. 26, 1903.* F11–3

——— [Oils from blackfish.] Report, 1902 (1904), p. 206–208.

True, Frederick William: [Porpoise oil.] Bulletin, 1885 (1885), vol. V, p. 5.

——— [Shark livers for oil.] Bulletin, 1885 (1885), vol. V, p. 301–302.

U. S. Bureau of Fisheries: [Fish oils.] Bulletin, 1888 (1890), vol. VIII, p. 51.

Wallem, Frederick Meltzer: Export of fish oil from Norway, 1878–1882. Bulletin, 1883 (1883), vol. III, p. 240, 382. F18–129; F18–340

White, George, and Adrian Thomas: Properties of fish and vegetable oil mixtures. Bulletin, 1912 (1913), vol. XXXII, p. 183–198, illus., *Doc. 785 issued Feb. 18, 1914.* F14–8

Wilcox, William A.: [Manufacture of herring oil.] Report, 1893 (1895), p. 303.

SKINS.

Baird, S. F.: [Utilization of the skins of fishes.] Report, 1886 (1889), p. 150.

Field, Irving A.: Utilized fishes and their relation to the fishing industries (Use of the skin of the dogfish: p. 41–42.) Report and special papers, 1916 (1917), 50 p., pl. *Doc. 622 issued Sept. 10, 1907.* 7–35352

Stevenson, Charles Hugh: [Utilization of the skins of sharks, rays, dogfish, and sturgeon.] Report, 1902 (1904), p. 281–352.

U. S. Commissioner of Fisheries: [Aquatic sources of leather.] Report, 1917 (1919), p. 50–51.

——— [Development of aquatic resources of leather.] Report, 1918, (1920), p. 37–38.

STOCK FEED.

Hinckley, Isaac: The fish-eating cows of Provincetown, Mass. Bulletin, 1881 (1882) vol. I, p. 134. F18–33,

Stevenson, C. H.: [Fish meal.] Bulletin, 1898 (1899), vol. XVIII, p. 551–552.

U. S. Commissioner of Fisheries: [Utilization of fish waste and waste fish.] Report, 1918 (1920), p. 34–35.

PRODUCTS AS FOOD.

PREPARATION.

General.

Stevenson, Charles H.: The preservation of fishery products for food. Bulletin, 1898 (1899), p. 335–563, VII pl. *Doc. 417 issued Dec. 12, 1899.* 5–5014

Alive.

Borne, Max von dem: Wooden tank for the transportation of living fish. Bulletin. 1884 (1884), vol. IV, p. 168, illus. F18–264

Mead, Albert Davis: A new principle of aquiculture and transportation of live fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 759–780, pl. XC–C, diagrs. *Doc. 676 issued April, 1910.* 10–35565

Pachaly's car for transporting fish. Bulletin, 1881 (1882), vol. I, p. 207–208. F18–40

Stevenson, Charles Hugh: [Preserving fishery products alive.] Bulletin, 1898 (1899), vol. XVIII, p. 339–357.

Transportation of live fish. Bulletin, 1882 (1883), vol. II, p. 95–102, illus. F18–80

Anchovies.

Stevenson, Charles Hugh: [Anchovie pastes and sardine butter.] Bulletin, 1898 (1899), vol. XVIII, p. 552–553.

Babracoted.

Quelch, J. J.: [Babracoted fish in British Guiana.] Bulletin, 1893 (1894), vol. XIII, p. 238.

Bloaters.

Earll, R. Edward: [Preparation of bloater herring at Eastport.] Bulletin, 1887 (1889), vol. VII, p. 273.

——— [Method of preparation of the bloater-herring.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. VI, p. 486–488.

Smith, Hugh McCormick: [Cured herring.] Bulletin, 1902 (1904), vol. XXII, p. 3–4.

Canning.

Adams, Emma Hildreth: Salmon canning in Oregon. Bulletin, 1885 (1885), vol. V, p. 362–365. F18–480

Alexander, Alvin B.: [Salmon canning industry of the Pacific coast.] Report, 1904 (1905), p. 141–146.

Bower, Ward Taft, and Henry D. Aller: Alaska fisheries and fur industries in 1914. (Canning: p. 29–37.) Appendix IX, Report, 1914 (1915), 89 p. *Doc. 819 issued Sept. 23, 1915.* F12–388

——— Alaska fisheries and fur industries in 1915. (Canning: p. 30–41.) Appendix III, Report, 1915 (1917), 140 p. *Doc. 834 issued Jan. 6, 1917.* F12–388

Bower, Ward Taft, and H. C. Fassett: [Salmon canning: p. 83–103.] *In* Alaska fisheries and fur industries in 1913, by Barton Warren Evermann. Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

Chamberlain, Frederick M., and Ward Taft Bower: [Salmon canning: p. 46–53.] *In* Fisheries and fur industries of Alaska in 1912, by Barton Warren Evermann. Report and special papers, 1912 (1914), 123 p. F12–388

Chittenden, Newton H.: [Salmon canning in British Columbia.] Bulletin, 1884 (1884), vol. IV, p. 313–314.

Cobb, J. N.: [Preserving fishery products by canning.] Bulletin, 1897 (1898), vol. XVII, p. 350–351.

——— The salmon fisheries of the Pacific coast. (Canning: p. 46–60.) Report and special papers, 1910 (1911), 179 p. *Doc. 751 issued Nov. 25, 1911.* F11–393

Cobb, J. N., and F. M. Chamberlain: [Salmon canning: p. 38–47.] *In* Alaska fisheries and fur industries in 1911, by B. W. Evermann. Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

Cobb, J. N., and H. M. Kutchin: The fisheries of Alaska in 1906. [Salmon canning: p. 13–17.] Report and special papers, 1906 (1908), 70 p. *Doc. 618 issued Dec. 31, 1906.* 7–35263

Collins, Joseph William: [Sardine canning industry in California.] Report, 1888–89 (1892), p. 158–159.

Earll, R. Edward: Proposed limitation of the herring fishery in Maine and its effect upon bait and canning interests. Bulletin, 1883 (1883), vol. III, p. 445–446. F18–177

——— [The mackerel canning industry; origin and development.] Report, 1881 (1884), p. 221–227.

Earll, R. Edward, and Hugh M. Smith: The American sardine industry in 1886. Bulletin, 1887 (1889), vol. VII, p. 161–192. *Doc. 123 issued June 20, 1889.* F11–252

Green, Loren W.: Report on the packing of salmon on the Pacific coast from 1883 to 1886. Bulletin, 1886 (1887), vol. VI, p. 286–288. F18–593

Goode, George Brown: [Manufacture of sardines from menhaden.] Report, 1877 (1879), p. 137–139.

Hall, Ansley: [The sardine industry of the Passamaquoddy region, Maine.] Report, 1896 (1898), p. 464–480.

Homergue, Louis C. d': [The sardine canneries of Fraser River.] Bulletin, 1884 (1884), vol. IV, p. 314.

Hume, R. D.: [The first salmon cannery: p. 46–48.] *Quoted* by Cobb *in* The salmon fisheries of the Pacific coast. Report and special papers, 1910 (1911), 179 p.

Kemp, N. H., and others: The sardine cannery industry of Eastport, Maine. [A petition to the secretary of the treasury.] Bulletin, 1885 (1885), vol. V, p. 241–243. F18–416

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Salmon canning: p. 34–39.) Report and special papers, 1907 (1909), 77 p., pls., charts, illus. *Doc. 632 issued Apr. 16, 1908.* 7–35263

——— The fisheries of Alaska in 1908. (Salmon canning: p. 19–23.) Report and special papers, 1908 (1910), 78 p. *Doc. 645 issued Apr. 17, 1909.* 7–35263

——— The fisheries of Alaska in 1909. (Salmon canning: p. 16–19.) Report and special papers, 1909 (1911), 58 p. 7–35263

——— The fisheries of Alaska in 1910. (Salmon canning: p. 15–21.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Moser, Jefferson F.: The salmon and salmon fisheries of Alaska. Report of the operations of the U. S. Fish commission steamer *Albatross* for the year ending June 30, 1898. Bulletin, 1898 (1899), vol. XVIII, 178 p. F12–94

——— The salmon fisheries of Alaska. Bulletin, 1901 (1902), vol. XXI, p. 173–398, illus., fold. tables and charts, XLIV pls. *Doc. 510 issued Oct. 31, 1902.* F12–278

The sardine fisheries. Tr. from the Danish by Herman Jacobson. Report, 1888–89 (1892), p. 163–165.

Schultz, Alexander: [Preparation of the products from the White Sea, the Arctic Ocean, and the Caspian Sea.] Report, 1873–74 and 1874–75 (1876), p. 25–96.

Smith, Hugh McCormick: [Sardines, anchovies, and sardine canning.] Bulletin, 1894 (1895), vol. XIV, p. 227–230.

——— [Mackerel canning in California.] Bulletin, 1894 (1895), vol. XIV, p. 231.

——— [Preparation of sardines in Maine.] Report, 1894 (1896), p. 142–143.

——— The French sardine industry. Bulletin, 1901 (1902), vol. XXI, 26 p. *Doc. 473 issued Sept. 26, 1901.* F12–266

Statistics of whaling, cod fishing, and salmon packing on the Pacific coast. Bulletin, 1886 (1887), vol. VI, p. 89–90. F18–544

Stevenson, Charles Hugh: [Sardines.] Bulletin, 1898 (1899), vol. XVIII, p. 526–537.

——— [The preservation of fishery products by canning.] Bulletin, 1898 (1899), vol. XVIII, p. 507–540.

Stone, Livingston: Best season for packing salmon on the Pacific coast. Bulletin, 1887 (1889), vol. VII, p. 65–66. F18–653

Tanner, Zera Luther: [Salmon canneries of Bristol Bay.] Report, 1889–91 (1893), p. 284–287.

U. S. Commissioner of Fisheries: [Tuna canning industry of California.] Report, 1914 (1915), p. 35–37.

——— [Home canning of fish.] Report, 1918 (1920), p. 35–37.

Walker, E. P.: [Mild cure in operations in southeast Alaska in 1914.] *Quoted by* W. T. Bower and H. D. Aller *in* Alaska fisheries and fur industries in 1914. Appendix IX, Report, 1914 (1915), 89 p. F12–388

Wilcox, William A.: [Packing sardines in California.] Report, 1893 (1895), p. 192.

——— [Notes on salmon canning on the Pacific coast.] Report, 1896 (1898), p. 583–587.

Caviar.

Cobb, John Nathan: [Preparation of caviar.] Report, 1899 (1900), p. 378–379.

Hovey, H. C.: [Preparation of caviar.] Bulletin, 1884 (1884), vol. IV, p. 346–348.

Radcliffe, Lewis: Caviar: what it is and how to prepare it. (Selected bibliography: p. 7–8.) 8 p., illus. *Economic Circular 20 issued Apr. 19, 1916.* F16–86

Ryder, John Adam: [Manufacture of caviar.] Bulletin, 1888 (1890), vol. VIII, p. 277–278.

Schultz, Alexander: [Manufacture of caviar.] Report, 1873–74 and 1874–75 (1876), p. 84–86.

Smith, Hugh McCormick, and Merwin-Marie Snell: [Manufacture of caviar.] Report, 1887 (1891), p. 249, 272, 288.

Stevenson, Charles Hugh: [The preservation of fish roe for food.] Bulletin, 1898 (1899), vol. XVIII, p. 541–546.

Townsend, Charles Haskins: [Caviar from paddle-fish.] Report, 1901 (1902), p. 160.

U. S. Commissioner of Fisheries: [Manufacture of caviar by fishermen.] Report, 1901 (1902), p. 581.

Cooking.

Behr, Friedrich von: Five recipes for cooking carp. Bulletin, 1886 (1887), vol. VI, p. 276. F18–590

Coker, Robert Ervin: The bowfin: an old-fashioned fish with a new-found use. 4 p., illus. *Economic Circular 26 issued May 11, 1917.* F17–188

[To cook carp.] Bulletin, 1886 (1887), vol. VI, p. 134.

Dolge, Alfred: The preparation and cooking of carp. Bulletin, 1886 (1887), vol. VI, p. 204–205. F18–575

Gerber, C.: How to cook carp. Bulletin, 1884 (1884), vol. IV, p. 151–152. F18–257

Gross, Julius: Another recipe for cooking carp. Bulletin, 1886 (1887), vol. VI, p. 277. F18–591

Haverfield, N. T.: [Recipe for cooking carp.] Bulletin, 1886 (1887), vol. VI, p. 401.

How to cook carp and tench. Bulletin, 1884 (1884), vol. IV, p. 139–140. F18–248

Moore, Henry Frank: The grayfish. Try it. It knocks H. out of the H. C. of L. 8 p., illus. *Economic Circular 22 issued Nov. 29, 1916.* F17–107

——— The sablefish, alias black cod. An introduction to one of the best and richest of American food-fishes, with recipes for cooking it, by Mary E. Rausch and J. C. Grant. 8 p., illus. *Economic Circular 23 issued Mar. 8, 1917.* F17–155

——— The burbot: a fresh-water cousin to the cod. (Recipes contributed by Mrs. Albert Sidney Burleson, Mrs. William C. Redfield, Lake Erie fishermen, and New England Exchange.) 4 p., illus. *Economic Circular 25 issued May 9, 1917.* F17–236

——— Why and how to use salt and smoked fish. Sixty-one ways of cooking them. (Collated and adapted from various sources by William C. Kendall . . . and Rose M. MacDonald.) 8 p. *Economic Circular 29 issued Aug. 8, 1917.* F17–244

——— The whiting: a good fish not adequately utilized. 4 p., illus. *Economic Circular 32 issued Oct. 10, 1917.* F17–265

——— The eulachon: a rich and delicious little fish. 4 p., illus. *Economic Circular 33 issued Dec. 5, 1917.* F18–1

——— Skates and rays. Interesting fishes of great food value, with 29 recipes for for cooking them. 7 p., illus. *Economic Circular 34 issued Mar. 20, 1918.* F18–516

——— Groupers: fishes you should try, with recipes for cooking them (by Evelyn Spencer.) 8 p., illus. *Economic Circular 44 issued Mar. 21. 1919.* F19–4

——— The haddock: one of the best salt-water fishes. With recipes for cooking it. 8 p., illus. *Economic Circular 47 issued Aug. 18, 1920.* F20–159

Radcliffe, Lewis: Sharks as food. With thirty recipes. 8 p. *Economic Circular 35 issued Apr. 29, 1918.* F18–683

——— Fish roe and buckroe. With 85 recipes (contributed by Lewis Radcliffe, Rose M. MacDonald, Olive B. Percival, L. Madeline McClintock, W. C. Kendall). 11 p. *Economic Circular 36 issued Apr. 23, 1918.* F18–684

Smiley, Charles Wesley: Notes on the edible qualities of the German carp and hints about cooking them. Bulletin, 1883 (1884), vol. III, p. 305–332. F11–311

Smith, Hugh McCormick: Commercial possibilities of the goose-fish: a neglected food; with 10 recipes (by Charles Doucot). 5 p. *Economic Circular 13 issued Dec. 15, 1914.* F14–131

Some recipes for cooking fish. Bulletin, 1886 (1887), vol. VI, p. 127–128. F18–560

Taylor, H. F.: The carp: a valuable food resource, with twenty-three recipes (selected). 7 p., illus. *Economic Circular 31 issued Sept. 26, 1917.* F17–258

U. S. Bureau of Fisheries: Canned salmon: cheaper than meats, and why. Including fifty tested recipes. 11 p. *Economic Circular 11 issued Mar. 7, 1914.* F14–35

——— The tilefish: a new deep-sea fish. With 12 recipes for cooking it by Charles Doucot. 6 p., illus. *Economic Circular 19 issued Sept. 30, 1915.* F15–156

——— [Experiments relating to the preservation of fishery products.] Report, 1918 (1920), p. 18–21.

Van Antwerp, W.: [Manner of cooking German carp.] Bulletin, 1882 (1883), vol. II, p. 300.

Wallen, Frederik Meltzer: [A culinary fish-dinner with international dishes.] Report, 1878 (1880), p. 80–83.

Warren & Co.: [How to cook the red snapper.] Bulletin, 1885 (1885), vol. V, p. 94–95.

Zeller, George A.: [Philippine fish-cakes.] Report, 1902 (1904), p. 140.

Dried.

Cobb, John Nathan: [Preparation of fishery products in the Hawaiian Islands.] Bulletin, 1903 (1905), vol. XXIII, p. 750–751.

Gundersen, H.: Drying codfish at Bordeaux. Bulletin, 1886 (1887), vol. VI, p. 84–86, illus. F18–542

Ito, K.: [Dried herring in Japan.] Bulletin, 1893 (1894), vol. XIII, p. 435.

A new process of drying fish. Bulletin, 1883 (1883), vol. III, p. 432.

Stevenson, Charles Hugh: [Chinese method of preserving, by drying, of shrimp, redfish, squid, sturgeon, and trepang.] Bulletin, 1898 (1899), vol. XVIII, p. 414–420.

——— [Drying fish by artificial means.] Bulletin, 1898 (1899), vol. XVIII, p. 420–424.

——— [The preservation of fishery products by drying and dry-salting.] Bulletin, 1898 (1899), vol. XVIII, p. 389–414.

Fish Eggs.

Stevenson, Charles H.: [The preservation of fish eggs for food.] Bulletin, 1898 (1899), vol. XVIII, p. 541–548.

Kippered.

Collins, Joseph William: [Kippered mackerel and methods of curing.] Bulletin, 1885 (1885), vol. V, p. 40.

Simonson, Carl: [Kippered herring.] Bulletin, 1886 (1887), vol. IV, p. 154–155.

Smith, Hugh M.: [Kippered herring.] Bulletin, 1902 (1904), vol. XXII, p. 4.

Klip fish.

Annaniasson, Abraham: Klip-fish at the Shetland Islands. Bulletin, 1885 (1885), vol. V, p. 316–319. F18–462

Friele, M.: [Preparation of cod in Norway.] Report, 1877 (1879), p. 716–717.

The **Manufacture** of klip-fish. Report, 1885 (1887), p. 325–351. F17–144

Thorsteinson, A.: [Manufacture of klip-fish.] Report, 1884 (1886), p. 315–319.

Trolle, C.: Salting fish in Jutland. Report, 1884 (1886), p. 411–419. F17–133

Miscellaneous processes.

Anderssen, Joakim: [Methods of preparing fish for markets.] Report, 1878 (1880), p. 47–71.

Baird, Spencer Fullerton: [Preservation of fish by drying, salting, smoking, etc.] Report, 1886 (1889), p. 133–138.

Bumpus, H. C.: [Preparation of fish as an article of food.] Bulletin, 1897 (1898), vol. XVII, p. 178–179.

Cobb, John Nathan: [Florida's fishery resources.] Bulletin, 1897 (1898), vol. XVII, p. 349–351.

——— [Preparation of fishery products in the Hawaiian Islands.] Report, 1901 (1902), p. 433–434.

Coker, Robert Ervin: [Preservation of fishery products in Peru.] Bulletin, 1908 (1910), vol. XXVIII, p. 347–354.

Collins, Joseph William: Report on the fisheries of the Pacific coast of the United States. [Frozen, canned, salted, dried fish-products from the whale. Use of by-products.] Report, 1888–89 (1892), p. 3–269.

Day, Francis: [Preparation of fishery products in India.] Report, 1883 (1885), p. 404 and 408.

Earll, Edward R.: [Pressing "kyacks" and shore-whaling for finbacks in Maine.] Bulletin, 1886 (1887), vol. VI, p. 312–313.

Ewart, James Cossar: The preservation of fresh fish. Bulletin, 1886 (1887), vol. VI, p. 65–75. F18–536

Field, Irving A.: Utilized fishes and their relation to the fisheries industries. Report and special papers, 1906 (1907), 50 p. *Doc. 622 issued Sept. 10, 1907.* 7–35352

Ito, K.: Fishery industries of the Island of Hokkaido, Japan. Bulletin, 1886 (1887), vol. VI, p. 342–345. F18–607

Jennings, Ralph S.: Process of preserving fish. Bulletin, 1883 (1883), vol. III, p. 336. F18–144

Kendall, William Converse: How the angler may preserve his catch. 7 p. *Economic Circular 37 issued June 6, 1918.* F18–687

Lawrence-Hamilton, J.: [Fish as cheap food.] Bulletin, 1893 (1894), vol. XIII, p. 332–333.

London, Fish Trades Gazette: [Establishments for utilizing fish products.] Bulletin, 1886 (1887), vol. VI, p. 414–415.

Malmros, Oscar: Preserving fish in Scotland by the Roosen process. (Dispatch No. 70 to State department.) Bulletin, 1885 (1887), vol. VI, p. 109–110. F18–550

Martin Brant's method of preserving fresh fish and other articles of food (by compressed air). Bulletin, 1884 (1884), vol. IV, p. 395–397. F18–349

Moore, Henry Frank: Preserving fish for domestic use. 2 p. *Economic Circular 28 issued May 26, 1917.* F17–241

[Preserving fish with boric acid.] Bulletin, 1886 (1887), vol. VI, p. 450.

Roosen, August R.: [The Roosen process of preserving fish.] Bulletin, 1886 (1887), vol. VI, p. 307–308.

Sölling, A.: An improved and practical method of packing fish for transportation. Bulletin, 1908 (1910), vol. XXVII, p. 295–301. *Doc. 659 issued February, 1910.* 10–35135

Stevenson, Charles Hugh: The preservation of fishery products for food. Bulletin, 1898 (1899), vol. XVII, p. 335–363, pl. *Doc. 417 issued Dec. 12, 1899.* 5–5014

Tower, Ralph Winfred: Improvements in preparing fish for shipment. Bulletin, 1899 (1901), vol. XIX, p. 231–235. *Doc. 443 issued Sept. 12,* 1900. F12–91

U. S. Bureau of Fisheries: [Use of antiseptic preservatives: Roosen process; Pursell process.] Report, 1887 (1891), p. 354–357.

Widegren, Hjalmar: On the herring and its preparation as an article of trade. Report, 1873–74 and 1874–75 (1876), p. 183–193. F16–11

——— [Preparing herring and cod for market.] Report, 1878 (1880), p. 130–140.

Wilcox, William A.: Notes on the fishery trade and local fisheries of Porto Rico. Report, 1899 (1900), p. 1–34 incl. tables. F11–104

Refrigeration.

Clark, A. Howard: Notes on the history of preparing fish for market by freezing. Bulletin, 1886 (1887), vol. VI, p. 467–469. F18–632

Gamgee, John: On artificial refrigeration. Report, 1877 (1879), p. 901–972, illus., 3 pl. *Doc. 26 issued Oct. 29, 1879.* F12–237

Lawrence-Hamilton, J.: [Refrigeration.] Bulletin, 1893 (1894), vol. XIII, p. 300–303.

Stevenson, Charles Hugh: [Preservation of fishery products by refrigeration and low temperature.] Bulletin, 1898 (1899), vol. XVIII, p. 358–388.

Salting.

Cobb, John Nathan: Pacific cod fisheries. (Preparing cod for market: p. 63–79.) Appendix IV, Report, 1915 (1917), 111 p. *Doc 830 issued Oct. 23, 1916.* F16–191

Clark, A. Howard: [To prevent fish from reddening.] Bulletin, 1885 (1885), vol. V, p. 79.

Collins, Joseph William: [Codfish curing in Newfoundland.] Report, 1887 (1891), p. 545–546.

Earll, Robert Edward: [Dressing cod—Methods of salting—Preservation of cod liver.] Report, 1878 (1880), p. 701–704.

Farlow, William Gibson: Vegetable parasites of codfish. Bulletin, 1886 (1887), vol. VI, p. 1–4, illus. F18–521

——— On the nature of the peculiar reddening of codfish during the summer season. Report, 1878 (1880), p. 969–974. F20–120

Friele, M.: [Salting codfish in Norway.] Report, 1877 (1879), p. 716–717.

Hall, Ansley: [Smoked and pickled herring industry of the Passamaquoddy region, Maine.] Report, 1896 (1898), p. 454–464.

Lawrence-Hamilton, J.: [Poisoning from red-salted codfish.] Bulletin, 1893 (1894), vol. XIII, p. 326–327.

——— [Bacterial infection of fish by impure preservatives.] Bulletin, 1893 (1894), vol. XIII, p. 326–327.

——— [Uses of salt in preserving fishes.] Bulletin, 1893 (1894), vol. XIII, p. 328–329.

Moser, Jefferson F.: [Salting salmon.] Bulletin, 1898 (1899), vol. XVIII, p. 21.

Methods of preparing fish bladders for market. Bulletin, 1886 (1887), vol. VI, p. 59–63. F18–534

[Salting and drying the tongues of codfish in Norway.] Bulletin, 1886 (1887), vol. VI, p. 318–319.

The salting of herring. Report, 1884 (1886), p. 421–433. F17–134

Salting roe in Norway. Bulletin, 1885 (1885), vol. V, p. 410–414. F18–485

Scudder, Newton Pratt: [Dressing and salting the halibut.] Report, 1880 (1883), p. 213–214.

Smidth, J. K.: Historical observations on the conditions of the fisheries among the ancient Greeks and Romans, and on their mode of salting and pickling fish. Report, 1873–74 and 1874–75 (1876), p. [3]–20. F16–2

Smith, Hugh McCormick: [White-cured herring.] Bulletin, 1902 (1904), vol. XXII, p. 5–7.

Stevenson, Charles Hugh: [The preservation of fishery products by pickling.] Bulletin, 1898 (1899), vol. XVIII, p. 425–473.

Swan, James G.: [Economical manner of putting up the black cod.] Bulletin, 1885 (1885), vol. V, p. 232–233.

Thorsteinson, A.: [Curing cod in Iceland.] Report, 1884 (1886), p. 316–322.

Tressler, Donald Kiteley: Some considerations concerning the salting of fish. (Bibliography: p. 55.) Appendix V, Report, 1919 (1921), 54 p. *Doc. 884 issued Mar. 20, 1920.* F20–109

Trolle, C.: Salting fish in Jutland. Report, 1884 (1886), p. 411–419. F17–133

Widegren, Hjalmar: On the herring and its preparation as an article of trade. Report, 1873–74 and 1874–75 (1876), p. 183–193. F16–11

——— [Preparation of the herring for the trade.] Report, 1878 (1880), p. 130–135.

——— [Method of preparing the Baltic codfish for market.] Report, 1878 (1880), p. 139–140.

Smoking.

Cobb, John Nathan: [Fishery products in the smoked state.] Bulletin, 1897 (1898), vol. XVII, p. 350–351.

——— [Smoking eels caught in Oneida River.] Report, 1903 (1905), p. 235–236.

Collins, Joseph William: Edible qualities of smoked kingfish (*Scomberomorus cavalla* Cuv.). Bulletin, 1885 (1885), vol. V, p. 359. F18–477

——— Proposition to prepare kingfish by smoking. Bulletin, 1885 (1885), vol. V, p. 360. F18–478

Earll, R. Edward: [Smoking of finnen haddies at Eastport.] Bulletin, 1887 (1889), vol. VII, p. 273–274.

——— [Methods of smoking herring.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. I, pt. VI, p. 473–485.

Garde, Aug.: Smoking herring in Denmark. Bulletin, 1885 (1885), vol. V, p. 417–422. F18–487

Ito, K.: [Curing fish in Japan.] Bulletin, 1893 (1894), vol. XIII, p. 435–437.

Smith, Hugh McCormick: Note on the Scotch methods of smoking haddocks. Report, 1901 (1902), p. 269–271. F11–23

——— [Red herring.] Bulletin, 1902 (1904), p. 4.

Stevenson, Charles H.: [The preservation of fishery products by smoking.] Bulletin, 1898 (1899), vol. XVIII, p. 474–506.

U. S. Bureau of Fisheries: [Salting and smoking eels.] Bulletin, 1885 (1885), vol. V, p. 306. F18–451

——— A practical small smokehouse for fish: How to construct and operate it. (Based on experiments by J. B. Southall, United States fisheries biological station, Fairport, Iowa.) 7 p., illus. *Economic Circular 27 issued May 17, 1917.* F17–184

——— Ibid. 8 p., illus. *Revised Oct. 25, 1917.* F17–264

——— Ibid. 12 p., illus. *Second revision February, 1918.* F18–685

U. S. Commissioner of Fisheries: [Smoked kingfish.] Report, 1885 (1887), p. LII–LIII.

NUTRITIVE VALUE.

American Carp Culture Association: [Edible qualities of carp.] Bulletin, 1886 (1887), vol. VI, p. 316.

Atwater, Wilber Olin: Report of progress of an investigation of the chemical composition and economical values of fish and invertebrates used for food. Undertaken for the U. S. Fish commission. Report, 1880 (1883), p. 231–285 incl. tables. F16–273

——— Table illustrative of the nutritive value of fish. Bulletin, 1884 (1884), vol. IV, p. 203–205. F13–97

——— Contributions to the knowledge of the chemical composition and nutritive value of American food-fishes and invertebrates. Report, 1883 (1885), p. 433–499 incl. tables. *Doc. 98 issued Aug. 16, 1886.* F11–242

——— The chemical composition and nutritive values of food-fishes and aquatic invertebrates. Report, 1888–89 (1892), p. 679–868 incl. tables, 9 fold. col. diagr. *Doc. 185 issued June 2, 1892.* Agr. 3–567

Baird, Spencer Fullerton: [Food value of carp.] Bulletin, 1884 (1884), vol. IV, p. 306.

——— [Value of fish as food.] Report, 1886 (1889), p. 144–149.

Brevoort, J. Carson: [The gurnard as an edible fish.] *Quoted by* Goode *in* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. III, p. 256–257.

Chittenden, Russel Henry, and George Cummins: On the relative digestibility of fish flesh in gastric juice. Report, 1884 (1886), p. 1109–1122 incl. tables. F17–138

Cole, Leon Jacob: [Food value of the carp.] Report, 1904 (1905), p. 604–607.

Collins, Joseph William: [Preservation of kingfish for food, by drying and salting.] Report, 1885 (1887), p. 271–273.

Davis, H. B.: Table qualities of carp. Bulletin 1882 (1883), vol. II, p. 317–318. F18–109

Dorrance, C.: [Value of shad as food.] Report 1881 (1884), p. 629.

[**Eels** consumed in England.] Bulletin, 1886 (1887), vol. VI, p. 139–140.

Field, Irving A.: Sea mussels and dogfish as food. Bulletin, 1908 (1910), vol. XXVIII, p. 241–257. *Doc. 655 issued 1910.* 10–35138

——— Utilized fish and their relation to the fishing industries. (Dogfish as food: p. 43–46.) Report and special papers, 1906 (1907), 50 p. *Doc. 622 issued Sept. 10, 1907.* 7–35352

Goode, George Brown: [Food preparations derived from menhaden.] Report, 1877 (1879), p. 139.

——— [The menhaden as a table fish.] Report, 1877 (1879), p. 135.

——— [Swordfish as an article of food.] Report, 1880 (1883), p. 363.

——— [Lampreys esteemed as an article of food.] Report, 1880 (1883), p. 363.

Henshall, James Alexander: Culture of the Montana grayling. [Food qualities: p. 4.] Report and special papers, 1906 (1908), 7 p. *Doc. 628 issued Dec. 11, 1907.* 7–35051

Hovey, H. C.: [Preparation of sturgeon for the table.] Bulletin, 1884 (1884), vol. VI, p. 347.

Jordan, David Starr: The habits and value for food of the American channel catfish (*Ictalurus punctatus*, Rafinesque). Bulletin, 1885 (1885), vol. V, p. 34. F18–372

Kendall, William Converse: [Silversides as food fish.] Report, 1901 (1902), p. 244–245.

——— [Food qualities of the commercial catfishes.] Bulletin, 1902 (1904), vol. XXII, p. 401–402.

——— American catfishes. (Food qualities: p. 19–20.) Report and special papers, 1908 (1910), 39 p. X pls. *Doc. 733 issued Aug. 23, 1910.* 10–35947

Kensington, E. T.: Composition of some of the food-fishes. Bulletin, 1884 (1884), vol. IV, p. 74–75. F18–225

Kenworthy, Charles James: Food qualities of tarpum (Megalops). Bulletin, 1884 (1884), vol. IV, p. 80. F18–230

Kostychev, Pavel Andreevich: Chemical composition of fish products, with some remarks on their nutritive value. Report, 1886 (1889), p. 1019–1025. F17–149

Lawrence-Hamilton, J.: Foul fish and filth fevers. Bulletin, 1893 (1894), vol. XIII, p. 311–334. *Doc. 268 issued 1894.* F12–183

Phillips, Barnet: [Edible qualities of the pole flounder (*Gyptocephalus cynoglossus*).] Bulletin, 1884 (1884), vol. IV, p. 317–318.

——— [Valuable food-fish of California.] Bulletin, 1894 (1895), vol. XIV, p. 230–231.

[**Sharks** as food in Iceland.] Bulletin, 1885 (1885), vol. V, p. 301.

Smiley, Charles Wesley: Notes on the edible qualities of German carp and hints about cooking them. Bulletin, 1883 (1883), vol. III, p. 305–332. F11–311

Smith, Hugh McCormick: [Edible qualities of whiting.] Report, 1894 (1896), p. 154–159.

——— [Value of catfishes, carp, shad, and bass as food.] Bulletin, 1895 (1896), vol. XV, p. 394, 395–403, 425, 456–457.

Sparks, George L.: [Porpoise as food.] Bulletin, 1885 (1885), vol. V, p. 215.

Taylor, H. F.: Possibilities of food from fish. 4 p. *Economic Circular 30 issued Aug. 28, 1917.* F17–245

Thompson, Edward: Edible qualities of carp. Bulletin, 1884 (1884), vol. IV, p. 176. F18–268

U. S. Commissioner of Fisheries: [Sharks utilized for food in South Carolina.] Report, 1903 (1905), p. 380.

White, George F., and Thomas Adrian: A new method for determination of the food value of proteins, with application to *Cynoscion regalis*. Bulletin, 1912 (1913), vol. XXXII, p. 175–181, illus. *Doc. 784 issued Feb. 18, 1914.* F14–5

Widegren, Hjalmar: On the herring and its preparation as an article of trade. Report, 1873–74 and 1874–75 (1876), p. 183–193. F16–11

Zeller: [Sinarapan as food in provinces of the Camarines.] Bulletin, 1901 (1902), vol. XXI, p. 169.

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Baird, Spencer Fullerton: On specimens received by the Smithsonian Institution from the United States Life-saving service [*Kogia goodei*]. Bulletin, 1884 (1884), vol. IV, p. 177–178. F13–93

Brice, John J.: Remarks on the movements and breeding-grounds of the fur-seal, based on observations made while on the United States naval patrol of Bering Sea in 1894. Report, 1894 (1896), 1 p. l., p. 573–577. *Doc. 317 issued Nov. 7, 1896.* F11–192

Brown, James Temple: Some notes on whales. Bulletin, 1883 (1883), vol. III, p. 411–416. F18–155

Collins, Joseph William: Adventure with a whale in the River Tay, Scotland. Compiled from newspaper clippings. Bulletin, 1884 (1884), vol. IV, p. 213–217. F18–285

Elliott, Henry W.: The habits of the fur seal. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. I, p. 75–113.

Evermann, Barton Warren: [Notes on mammals noticed in Montana and Wyoming.] Bulletin, 1891 (1893), vol. XI, p. 55–56.

Fisher, J. G.: [Capture of a young blackfish.] Bulletin, 1885, (1885) vol. V, p. 467.

Goode, G. Brown: The seals and walruses. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. I, p. 33–74.

——— The whales and porpoises. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. I, p. 7–32.

——— [Destructiveness of whales and porpoises.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. I, p. 15–17.

Hector, James: [Fur seals of New Zealand.] Bulletin, 1884 (1884), vol. IV, p. 53.

Hinkelmann: Injuries to the fisheries in the Baltic by seals. Bulletin, 1887 (1889), vol. VII, p. 81–83. F18–643

Hobbs, James R.: Stranding of a pigmy sperm-whale. Bulletin, 1885 (1885), vol. V, p. 450. F18–507

Merriam, C. Hart: [Food of sea lions.] *Quoted* by Smith. Report, 1902 (1904), p. 113–114.

Milan, Thomas: [Stranding of a finback whale at Mount Desert light station.] Bulletin, 1885 (1885), vol. V, p. 337.

Osgood, Wilfred Hudson; Edward Alexander Preble; and George Howard Parker: The fur seals and other life of the Pribilof Islands, Alaska, in 1914. (Bibliography, comp. by Rose M. McDonald: p. 149–167.) Bulletin, 1914 (1915), vol. XXXIV, p. 1–172, pl. I–XVIII, 24 maps (part. fold.). *Doc. 820 issued June 19, 1915.* F15–85

Proctor, A. H.: [Foxing operations of St. George Island: p. 100–102.] *In* Alaska fisheries and fur industries in 1918. Appendix VII, Report, 1918 (1920).

Rutter, Cloudsley; Snodgrass; and Starks: [Report on the sea-lion investigations, 1901.] Report, 1902 (1904), p. 116–119.

San Francisco Bulletin: [Destructiveness of sea lions.] *Quoted* by Smith. Report, 1902 (1904), p. 111–112.

Siglin, Zachary T.: [Sea-lions on the coast of Oregon.] Bulletin, 1886 (1887), vol. VI, p. 140.

Slade, Elisha: Dates of the appearance of herring, shad, tautog, scup, frostfish, fishhawk, kingfishers, and Greenland seals in Tauton River from 1871 to 1883, inclusive. Bulletin, 1883 (1883), vol. III, p. 478. F18–201

Smiley, Charles Wesley: First appearance of porpoise. Bulletin, 1883 (1883), vol. III, p. 272. F18–132

Smith, Hugh McCormick: [Destructiveness of sea lions.] Report, 1902 (1904), p. 111–119.

Stanley-Brown, Joseph: Past and future of the fur-seal. Bulletin, 1893 (1894), vol. XIII, p. 361–370. *Doc. 273 issued June 9, 1894.* F12–183

Stejneger, Leonhard Hess: The Russian fur-seal islands. Bulletin, 1896 (1896), vol. XXVI, 148 p., 66 pl. (partly fold.). *Doc. 316 issued Nov. 13, 1896.* F11–354

Swan, James G.: Report of investigations at Neah Bay, Wash., respecting the habits of fur seals of the vicinity, and to arrange for procuring specimens of skeletons of Cetacea. Bulletin, 1883 (1883), vol. III, p. 201–207. F12–381

Tanner, Zera Luther: Occurrence of fur-seals in mid-ocean. Bulletin, 1882 (1883), vol. II, p. 216. F18–98

True, Frederick William: Suggestions to keepers of the U. S. life-saving stations, light-houses, and light-ships; and to other observers, relative to the best means of collecting and preserving specimens of whales and porpoises. Report, 1883 (1885), 26 p., XI pl. F11–306

——— Catalogue of the aquatic mammals exhibited by the United States National museum. (At head of title: Great International fisheries exhibition. London, 1883. H.) 22 p. *Doc. 74 issued May 9, 1884.* F18–390

——— The sirenians or sea-cows. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. I, p. 114–136.

——— Report of a trip to Long Island in search of skeletons of the right whale, *Balaena cisartica.* Bulletin, 1885 (1885), vol. V, p. 131–132. F18–387

——— Notice of the capture of a male pigmy sperm whale—*Kogia breviceps*—at Kitty Hawk, North Carolina. Bulletin, 1885 (1885), vol. V, p. 132–134. F18–388

——— Notes on a porpoise of the genus Prodelphinus from the Hawaiian Islands. Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 809–815. *Doc. 544 issued Sept. 18, 1903.* F11–381

Trumbull, J. Hammond: [*Dubertus rhodinsulensis.*] *Quoted by* Goode *in* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. I, p. 29–30.

U. S. Bureau of Fisheries: [Sea-lion rookery.] Bulletin, 1888 (1890), vol. VIII, p. 37.

EMBRYOLOGY.

Ryder, John Adam: On the development of the mammary glands and genitalia of the Cetacea. (Bibliography: p. 141–142.) Bulletin, 1885 (1885), vol. V, p. 135–142. F18–390

——— On the development of the Cetacea, together with a consideration of the probable homologies of the flukes of Cetaceans and Sirenians. Report, 1885 (1887), p. 427–488, III, pl. F11–297

INDUSTRIES.

SEALING.

Bower, Ward T.: Alaska fisheries and fur industries in 1918. Appendix VII, Report, 1918 (1920), 128 p. *Doc. 872 issued Dec. 8, 1919.* F12–388

——— Alaska fisheries and fur industries in 1919. Appendix IX, Report, 1919 (1921), 160 p. *Doc. 891 issued Dec. 11, 1920.* F12–388

Bower, Ward T., and Henry D. Aller: Alaska fisheries and fur industries in 1914. Appendix IX, Report, 1914 (1915), 89 p. *Doc. 819 issued Sept. 23, 1915.* F12–388

——— Alaska fisheries and fur industries in 1915. Appendix III, Report, 1915 (1917), 140 p. *Doc. 834 issued Jan. 6, 1917.* F12–388

——— Alaska fisheries and fur industries in 1916. Appendix II, Report, 1916 (1917), 118 p. *Doc. 838 issued Aug. 14, 1917.* F12–388

——— Alaska fisheries and fur industries in 1917. Appendix II, Report, 1917 (1919), 123 p. *Doc. 847 issued Dec. 28, 1918.* F12–388

Clark, A. Howard: The blackfish and porpoise fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVI, p. 295–310.

——— The Pacific walrus fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVII, p. 311–318.

——— The Antarctic fur-seal and sea-elephant industry. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVIII, p. 400–467.

——— The North-Atlantic seal-fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVIII, p. 474–483.

Cobb, John Nathan: [Seal fishery of the Hawaiian Islands.] Report, 1901 (1902), p. 496–497.

——— Commercial fisheries of Alaska in 1905. (Fur-seal: p. 31–33.) Report and special papers, 1905 (1907), 46 p.

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Fur-seal: p. 58.) Report and special papers, 1906 (1908), 70 p.

Collins, Joseph William: [Fur-seal industry of the Pacific coast of the United States.] Report, 1888–89 (1892), p. 3–269.

Elliott, Henry W.: A monograph of the seal islands of Alaska. Reprinted, with additions, from the report on the fishery industries of the tenth census (Special bulletin 176). 1882. 176 p., illus., XXIX pl., 2 fold. maps. 10–9891

——— The sea-lion hunt. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVIII, p. 467–474.

——— The fur-seal industry of the Pribilof Islands, Alaska. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, pt. XVIII, p. 319–393.

Elliott, Henry W.: The sea-otter fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVIII, p. 483–491.

Evermann, Barton Warren: Alaska fisheries and fur industries in 1911. (*Contents.*—General administrative report, by B. W. Evermann and F. M. Chamberlain. Statistics of the fisheries of Alaska for 1911, by J. N. Cobb and F. M. Chamberlain. Fish culture in Alaska, by W. T. Bower. The fur-seal service in 1911, by W. I. Lembkey.) Report and special papers, 1911 (1913), 99 p. *Doc. 766 issued Dec. 16, 1912.* F12–388

——— Fishery and fur industries of Alaska in 1912. (*Contents.*—General administrative report, by B. W. Evermann. Fishery industries, by Fred M. Chamberlain and Ward T. Bower. Fur-seal service, by Walter Lembkey. Minor fur industries, by Harry J. Christoffers and Lee R. Dice.) Report and special papers, 1912 (1914), 123 p. *Doc. 780 issued Nov. 6, 1913.* F12–388

——— Alaska fisheries and fur industries in 1913. (*Contents.*—General administrative report, by B. W. Evermann. Fishery industries, by Ward T. Bower and Harry Clifford Fassett. Fur-seal service, by Walter I. Lembkey.) Appendix II, Report, 1913 (1914), 172 p. *Doc. 797 issued Aug. 29, 1914.* F12–388

Friele, M.: [Seal fisheries of Norway in 1877.] Report 1877 (1879), p. 735–736.

Hanna, G. Dallas: Fur-seal census, Pribilof Islands, 1918, 1919. *In* Alaska fisheries and fur industries in 1918, 1919. Appendix V, Report, 1918 (1920), p. 116–128; Appendix IX, Report, 1919 (1921), p. 106–117. F12–388

Heath, Harold: Special investigation of the Alaska fur-seal rookeries, 1910. Report and special papers, 1910 (1911), 22 p. *Doc. 748 issued Nov. 10, 1911.* F11–374

Jones, Ernest Lester: Report of Alaska investigations in 1914. 1915. 155 p., illus. F15–10

Lembkey, Walter: [The fur-seal fisheries: p. 54–58.] *In* The fisheries of Alaska in 1909, by Millard Caleb Marsh and John N. Cobb. Report and special papers, 1909 (1910), 55 p.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Fur-seals: p. 57–59.) Report and special papers, 1907 (1909), 64 p.

——— The fisheries of Alaska in 1908. (Fur-seals: p. 73.) Report and special papers, 1909 (1911), 58 p.

——— The fisheries of Alaska in 1910. (Fur-seal: p. 56–58.) Report and special papers, 1910 (1911), 65 p.

Osgood, Wilfred Hudson; Edward Alexander Preble; and George Howard Parker: The fur-seals and other life of the Pribilof Islands, Alaska, in 1914. (Bibliography, comp. by Rose M. McDonald: p. 149–167.) Bulletin, 1914 (1915), vol. XXXIV, p. 1–72, pl. I–XVIII, 24 maps (part. fold.). *Doc. 820 issued June 19, 1915.* F15–85

Schultz, A.: Account of the fisheries and seal-hunting in the White Sea, the Arctic Ocean, and the Caspian Sea. Report, 1873–74 and 1874–75 (1876), p. 35–96.

Smith, Hugh McCormick: [Fur-seal fishery.] Report, 1892 (1894), p. CLXXIII–CLXXVI.

Southwell, Thomas: Notes on the seal and whale fishery in 1886. Bulletin, 1887 (1889), vol. VII, p. 11–16.

Stanley-Brown, Joseph: Past and future of the fur seal. Bulletin, 1893 (1894), vol. XIII, p. 361–370. *Doc. 273 issued June 9, 1894.* F12–183

Stearns, Winfrid Alden: [Seals and seal hunting on the coast of Labrador.] Bulletin, 1885 (1885), vol. V, p. 19–25.

Stejneger, Leonhard: The Russian fur-seal islands. Bulletin, 1896 (1897), vol. XVI, 148 p., 60 pl. (partly fold.). *Doc. 316 issued Nov. 13, 1896.* F11–354

Swan, James G.: The fur-seal industry of Cape Flattery and vicinity. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XVIII, p. 393–400.

Townsend, Charles H.: The American seal herd and pelagic sealing. Report, 1898 (1899), p. CLXIV–CLXV.

——— [Condition of the fur-seal fisheries of the Pribilof Islands.] Report, 1900 (1901), p. 177–178.

——— [Notes on the London fur-seal trade.] Report, 1902 (1904), p. 158–160.

——— Fur seals and the seal fisheries. Bulletin, 1908 (1910), vol. XXVIII, p. 315–322. *Doc. 661 issued February, 1910.* 10–35157

Townsend, Eben: [Narrative of an Antarctic sealing voyage in the ship *Neptune*, 1796–1799.] *Quoted by* Clark *in* The fisheries and fishery industries of the United States. 1887. Sec. V, pt. XVIII, p. 460–467.

U. S. Bureau of Fisheries: Truth about the fur-seals of the Pribilof Islands. Statement of Dr. David Starr Jordan and Mr. George A. Clark. 7 p. *Economic Circular 4 issued Dec. 20, 1912.* F13–1

——— [Statistics of the Newfoundland seal and herring fisheries for 1914–1915.] Report, 1915 (1917), p. 63.

U. S. Bureau of Fisheries: [Statistics of the Alaska fur-seal service in 1917.] Report, 1917 (1919), p. 91–94.

Wilcox, William A.: [Pelagic fur-seal fishery of the Pacific coast.] Report, 1893 (1895), p. 201–202.

WHALING.

Brown, James Temple: The whale fishery and its appliances. (At head of title: Great International fisheries exhibition. London, 1883. United States of America. E.) 116 p. 8–27229

——— [The whale fishery.] Bulletin, 1885 (1885), vol. V, p. 466.

——— The whalemen, vessels and boats, apparatus, and methods of the whale fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XV, p. 218–293.

Chamberlain, Fred M., and Ward T. Bower: [Whale fishery: p. 67–70.] *In* Fishery and fur industries of Alaska in 1912, by B. W. Evermann. Report and special papers, 1912 (1914), 123 p. F12–388

Clark, A. Howard: The whale-fishery. History and present condition of the fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XV, p. 1–218.

Cocks, Alfred Heneage: The finwhale fishery on the Lapland coast in 1886. Bulletin, 1887 (1889), vol. VII, p. 109–110. F18–659

Collins, Joseph William: [Whale fishery of the Pacific coast of the United States.] Report, 1888 (1891), p. 74–91.

Crèvecoeur, Michel Guillaume St. Jean de, called Saint John de Crèvecoeur: An account of the whale fishery of Nantucket, Mass., one hundred years ago. (From letters of an American farmer. London, 1782, p. 162–171.) Bulletin, 1883 (1883), vol. III, p. 179–182. F12–378

Friele, M.: [Whale fisheries of Norway in 1877.] Report, 1877 (1879), p. 735.

Glasgow Herald: [The Greenland whale fishing.] Bulletin, 1885 (1885), vol. V, p. 467.

Hector, James: The fisheries of New Zealand. Bulletin, 1884 (1884), vol. IV, p. 53–55. F18–216

Japan. Bureau of Agriculture: The fisheries of Japan. Bulletin, 1893 (1894), vol. XIII, p. 419–438. F12–183

Juel, Niels: The whale fishery of Norway. Bulletin, 1885 (1885), vol V, p. 63–64. F18–379

Sanford, F. C.: Notes upon the history of the American whale fishery. Report, 1882 (1884), p. 205–220. F16–325

Smiley, Charles Wesley: Review of the whale fishery for 1882 and 1883. Report, 1883 (1885), p. 325–336 incl. tables. F17–28

Smith, Hugh McCormick: [Statistics of the whale fishery.] Report, 1892 (1894), p. CLXXII-CLXXIII.

——— [Statistics of the whale fishery.] Report, 1893 (1895), p. 71.

——— [Pacific whale fishery.] Bulletin, 1894 (1895), vol. XIV, p. 286–287.

——— [Statistics of the whale fishery.] Report, 1894 (1896), p. 132.

Southwell, Thomas: The bottle-nose whale fishery in the North Atlantic Ocean. Report, 1882 (1884), p. 221–227. F16–330

——— Notes on the seal and whale fishery in 1886. Bulletin, 1887 (1889), vol. VII, p. 11–16.

Starbuck, Alexander: History of the American whale fishery from its earliest inception to the year 1876. (Index to voyages by vessels' names: p. 711–763.) Report, 1875-76 (1878), 779 p. incl. plates, VI pl. F16–68

Statistics of whaling, cod-fishing, and salmon packing on the Pacific coast. Bulletin, 1886 (1887), vol. VI, p. 89–90 incl. tables F18–544

Stearns, Winfrid Alden: The Labrador fisheries. Bulletin, 1885 (1885), vol. V, p. 6–27. F18–366

Svend Foyn's whaling establishment. Report, 1883 (1885), p. 337–340. F17–29

Townsend, Charles Haskins: Present condition of the California whale fishery. Bulletin, 1886 (1887), vol. VI, p. 346–350, pl. VI-VII. F18–609

——— [Statistics of the whale fishery.] Report, 1899 (1900), p. CL.

——— [Statistics of the whale fishery.] Report, 1900 (1901), p. 178.

U. S. Commissioner of Fisheries: [Statistics of the whale fishery.] Report, 1906 (1908), p. 18.

Wilcox, William A.: [Whale fisheries of the Pacific coast. Report 1893 (1895), p. 202–206.

——— [Statistics of the whale fisheries of the Pacific coast in 1904.] Report and special papers, 1905 (1907), p. 140–141.

PRODUCTS.

PRESERVATION OF PRODUCTS.

GENERAL.

Stevenson, Charles Hugh: Aquatic products in arts and industries. Fish oils, fats, and waxes. Fertilizers from aquatic products. Report, 1902 (1904), p. 177–279, pl. 10–25. *Doc. 536 issued Sept. 26, 1903.* F11–3

——— Utilization of the skins of aquatic animals. Report, 1902 (1904), p. 281–352, pl. 26–38. *Doc. 537 issued Sept. 28, 1903.* F11–4

Williams & Co.: [The value of a whale.] Bulletin, 1884 (1884), vol. IV, p. 360.

AMBERGRIS.

Stevenson, Charles Hugh: [Ambergris.] Report, 1902 (1904), p. 247–252.

FURS.

Cobb, John Nathan: The commercial fisheries of Alaska in 1905. (Aquatic furs: p. 29–33.) Report and special papers, 1905 (1907), 46 p.

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Aquatic furs: p. 56–58.) Report and special papers, 1906 (1908), 70 p.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1907. (Aquatic furs: p. 55–59.) Report and special papers, 1907 (1909), 64 p.

——— The fisheries of Alaska in 1908. (Aquatic furs: p. 71–73.) Report and special papers, 1908 (1910), 78 p.

——— The fisheries of Alaska in 1909. (Aquatic furs: p. 54–57) Report and special papers, 1909 (1911), 58 p.

——— The fisheries of Alaska in 1910. (Aquatic furs: p. 54–58) Report and special papers, 1910 (1911), 65 p.

Stevenson, Charles Hugh: Utilization of the skins of Aquatic animals. Report 1902 (1904), p. 281–352, pl. 26–38. *Doc. 537 issued Sept. 28, 1903.* F11–4

Willson, J. M.: Florida fur-farming. Bulletin, 1897 (1898), vol. XVII, p. 369–371. *Doc. 396 issued Aug. 8, 1898.* F12–183

OIL.

Habershaw, Frederick: Bringing whale oil from the Pacific to New York. Bulletin, 1882 (1883), vol. II, p. 215. F18–97

Oil, paint, and drug reporter: [Whale and sperm oils.] *Quoted by* Clark *in* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XV, p. 162–164.

Sparks, George L.: Porpoise products. Bulletin, 1885 (1885), vol. V, p. 415–416. F18–486

——— [Porpoise oil.] Bulletin, 1885 (1885), vol. V, p. 415.

Stevenson, Charles Hugh: [Oil from blackfish.] Report, 1902 (1904), p. 209–268.

Stull, D. C.: [Oil from blackfish.] Bulletin, 1885 (1885), vol. V, p. 91.

True, Frederick William: [Porpoise oil.] Bulletin, 1885 (1885), vol. V, p. 5.

MISCELLANEOUS.

Cobb, John Nathan: Commercial fisheries of Alaska in 1905. (Miscellaneous aquatic animals: p. 33–38.) Report and special papers, 1905 (1907), 46 p.

Cobb, John Nathan, and Howard M. Kutchin: The fisheries of Alaska in 1906. (Miscellaneous aquatic mammals: p. 59.) Report and special papers, 1906 (1908), 70 p.

Marsh, Millard C., and John Nathan Cobb: The fisheries of Alaska in 1907. (Miscellaneous aquatic mammals: p. 59–61.) Report and special papers, 1907 (1909), 64 p.

——— The fisheries of Alaska in 1908. (Miscellaneous aquatic products and resources: p. 74–77.) Report and special papers, 1908 (1910), 78 p.

——— The fisheries of Alaska in 1910. (Miscellaneous aquatic mammals: p. 58–60.) Report and special papers, 1910 (1911), 65 p.

Stevenson, Charles Hugh: [Spermaceti.] Report 1902 (1904), p. 244.

——— Whalebone: its production and utilization. Report and special papers, 1906 (1908), 12 p. *Doc. 626 issued Oct. 30, 1907.* 7–35395

PRODUCTS AS FOOD.

Radcliffe, Lewis: Whales and porpoises as food. (With thirty-two recipes furnished by American Pacific Whaling Co., Mrs. Evelene Spencer; Delmonico; chef, Neuces hotel, Corpus Christi; Victory kitchen, San Antonio; Gedney's restaurant, San Marcos; and Mrs. Charles S. Smith.) 10 p. *Economic Circular 38 issued Nov. 6, 1918.* F18-700,

Sparks, George L.: [Porpoise as food.] Bulletin, 1885 (1885), vol. V, p. 215.

Sterling, Williams: [Extract of whale flesh.] *Quoted by* Stevenson. Bulletin, 1898 (1899), vol. XVIII, p. 550-551.

LEGISLATION.

Brice, John J.: [Law enacted by Bering Sea arbitration tribunal for protection of fur seals.] Report, 1894 (1896), p. 573.

Christoffers, H. J. and Lee R. Dice: [Observance of the fur law and regulations: p. 122.] *In* Fishery and fur industries of Alaska in 1912. Report and special papers, 1912 (1914), 123 p.

Protection of whales. Bulletin, 1881 (1882), vol. I, p. 17-19. F18-7

Rathbun, Richard: Modus vivendi prohibiting pelagic sealing. Report, 1892 (1894), p. LXXXIX-XC.

U. S. Commissioner of Fisheries: Laws and regulations relative to fur-seal fishing. (Act of Congress approved Dec. 29, 1897.) Report and special papers, 1909 (1911), 7 p. *Doc. 732 issued Mar. 11, 1910.* 10-35457

——— [Treaty affecting the fur-seals.] Report, 1911 (1913), p. 59-60.

U. S. President (Wilson): [Proclamation for preservation and protection of fur seals.] *Quoted in* Report, 1913 (1914), p. 72-73.

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REPTILES AND BATRACHIANS.

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Chamberlain, Frederick M.: Notes on the edible frogs of the United States and their artificial propagation. Report, 1897 (1898), p. 249–261, illus. *Doc. 348 issued Sept. 15, 1897.* Also *in* Manual of fish-culture, rev. ed., 1900, p. 249–261, illus.

Clark, H. Walton, and John B. Southall: Fresh-water turtles: a source of meat supply. Appendix VII, Report, 1919 (1921), 20 p., VIII pl. *Doc. 889 issued July 30, 1920.* F20–157

Downman, R. H.: What frogs sometimes eat. Bulletin, 1883 (1883), vol. III, p. 392. F18–150

Dukehart, J. P.: Transfer of soft-shell terrapin from the Ohio to the Potomac River. Bulletin, 1884 (1884), vol. IV, p. 143. F18–252

Evermann, Barton Warren: [Annotated list of batrachians collected in Montana and Wyoming.] Bulletin, 1891 (1893), vol. XI, p. 57–59.

[Frog-farming.] Bulletin, 1885 (1885), vol. V, p. 339.

Green, Seth: Frog-culture. Report, 1872 and 1873 (1874), p. 587–588. F15–121

Hay, William Perry: A revision of Malaclemmys, a genus of turtles. Bulletin, 1904 (1905), vol. XXIV, p. 3–19, col. front., XII pl. (partly col.). *Doc. 557 issued Feb. 8, 1908.* F12–1

Hay, William Perry, and Henry D. Aller: Artificial propagation of the diamond-back terrapin. 14 p., illus. *Economic Circular 5 issued June 24, 1913.* F13–225

——— Artificial propagation of the diamond-back terrapin. 21 p., illus. *Economic Circular 5, revised, issued Mar. 17, 1917.* F17–154

Japan. Bureau of Agriculture: The [turtle] fisheries of Japan. Bulletin, 1893 (1894), vol. XIII, p. 421. F12–183

Kirsch, Philip H.: A report upon explorations made in Eel River basin in the northeastern part of Indiana in the summer of 1892. Bulletin, 1894 (1895), vol. XIV, p. 31–41. *Doc. 235 issued Mar. 24, 1894.* F12–175

——— [Batrachians from the Maumee River basin.] Bulletin, 1894 (1895), vol. XIV, p. 333.

——— [List of reptiles from the Maumee River basin.] Bulletin, 1894 (1895), vol. XIV, p. 333.

McGehee, Montford: [Terrapin culture in North Carolina.] Bulletin, 1885 (1885), vol. V, p. 467.

Mitsukuri, Kakichi: [The snapping turtle, or soft-shell tortoise, "suppon."] Bulletin, 1904 (1905), vol. XXIV, p. 260–266, illus., pl. II–III.

Monroe, Ralph M.: The green turtle, and the possibilities of its protection and consequent increase on the Florida coast. Bulletin, 1897 (1898), vol. XVII, p. 273–275. *Doc. 380 issued Aug. 8, 1898.* F12–110

Parramore, T. H.: [Diamond-backed terrapin.] Bulletin, 1885 (1885), vol. V, p. 77–78.

Smith, Hugh McCormick: [Notes on the alligator industry of Florida.] Bulletin, 1891 (1893), vol. XI, p. 343–345.

——— [Terrapin and terrapin fishing in California.] Bulletin, 1894 (1895), vol. XIV, p. 281–282.

Test, Frederick C.: [Batrachians and reptiles collected in Missouri and Texas in 1891.] Bulletin, 1892 (1894), vol. XII, p. 121–122.

True, Frederick William: The useful aquatic reptiles and batrachians of the United States. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 137–162. *Doc. 222 issued Nov. 2, 1893.* F12–298

——— [The alligator and the crocodile.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 141–146.

——— [Economic use of alligators.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 146.

——— [Tortoises, turtles and terrapins.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 147–158.

True, Frederick William: [Economic value of the tortoises, turtles, and terrapins.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 148, 149, 151, 152, 153, 154, 157.

——— [The bullfrog.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 159–162.

——— [Frogs as food.] *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. II, p. 160–162.

——— The turtle and terrapin fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, pt. XVIII, p. 493–503.

U. S. Bureau of Fisheries: [Cultivation of the diamond-back terrapin.] Report, 1914 (1915), p. 67 1915 (1917), p. 35–36.

Van Denburg, John: [Annotated list of batrachians and reptiles in Columbia River basin.] Bulletin, 1894 (1895), vol. XIV, p. 206–207.

Wright, A. H.: Frogs: their natural history and utilization. Appendix VI, Report, 1919 (1921), 44 p., illus., XXII pl. *Doc. 888 issued July 29, 1920.* F20–156

BIRDS.

American birds, animals, and fishes for New Zealanders. Bulletin, 1881 (1882), vol. I, p. 53–54.

Collins, Joseph William: Notes on the habits and methods of capture of various species of sea birds that occur on the fishing banks off the eastern coast of North America, and which are used as bait for catching codfish by New England fishermen. Report, 1882 (1884), p. 311–338, pl. F16–311

Fisher, Walter Kenrick: Birds of Laysan and the Leeward Islands, Hawaiian group. Bulletin, 1903 (1906), vol. XXIII, part III, p. 767–807, col. front., illus., 10 pl. *Doc. 543 issued Sept. 18, 1903.* F11–379

Hanna, G. Dallas: [Birds of Pribilof Islands: p. 105–107.] *In* Alaska fisheries and fur industries in 1918. Appendix V, Report, 1918 (1920).

Harvie-Brown, J. A.: On the migration of birds in the spring and autumn of 1884. Bulletin, 1885 (1885), vol. V, p. 221–224. F18–412

Slade, Elisha: Dates of the appearance of herring, shad, bass, tautog, scup, fish-hawk, kingfishers, and Greenland seals in Tauton River from 1871 to 1883, inclusive. Bulletin, 1883 (1883), vol. III, p. 478. F18–201

[**White** herons eat their weight.] Bulletin, 1885 (1885), vol. V, p. 341.

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BIBLIOGRAPHIES.

Stevenson, Charles Hugh: A bibliography of publications in the English language relative to oysters and the oyster industries. Report, 1892 (1894), p. 305–359. *Doc. 286 issued Dec. 26, 1894.* F14–57

——— [Chronological list of publications relative to the oyster industry of Maryland.] Bulletin, 1892 (1894), vol. XII, p. 296–297.

U. S. Commissioner of Fisheries: [List of important works on oysters published during 1883.] Report, 1883 (1885), p. XC–XCII.

GENERAL.

Ingersoll, Ernest, and John Adam Ryder: Natural history of economic mollusks of the United States. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. IV, p. 687–758, pl. 253–259. *Doc. 223 issued Nov. 16, 1893.* F12–294

Moser, Jefferson F.: [Description of oyster banks.] Report, 1897 (1898), p. CLXX.

Verrill, Addison Emory: Report on the invertebrate animals of Vineyard Sound and adjacent waters, with an account of the physical features of the region. Report, 1871 and 1872 (1873), p. 295–778, XXXVIII pl. F15–102

PHYSIOLOGY.

NUTRITION.

Mitchell, Philip Henry: Nutrition of oysters, glycogen formation and storage. Bulletin, 1915–16 (1918), vol. XXXV, p. 153–161. *Doc. 851 issued Apr. 11, 1917.* F17–248

——— The nature of the so-called "fattening" of oysters. Bulletin, 1915–16 (1918), vol. XXXV, p. 477–483. *Doc. 860 issued Mar. 13, 1918.* F18–514

GROWTH.

Churchill, E. P.: [Growth of the oyster.] Appendix VIII, Report, 1919 (1921), p. 14.

Glaser, O. C.: [Observations and experiments on the growth of the oyster.] Report, 1903 (1905), p. 329–341, incl. tables, fold. map.

Möbius, Karl: [Size of shell of full grown oyster.] Report, 1880 (1883), p. 715.

Moore, Henry Frank: [Rate of growth of the oyster.] Report, 1897 (1898), p. 274–275; also *in* Manual of fish-culture, rev. ed., 1900, p. 274–275.

——— [Rate of growth of Louisiana oysters.] Report, 1898 (1899), p. 89–90.

——— [Anatomy, embryology, and growth of the oyster.] Report, 1903 (1905), p. 317–327, incl. tables, illus., pls.

Ryder, John Adam: Journal of operations on the grounds of the Eastern Shore oyster company, Chincoteague Bay, near Stockton, Md., during the summer of 1883. Bulletin, 1884 (1884), vol. IV, p. 43–47. F18–210

——— The rate or growth of oysters at St. Jeromes Creek station. Bulletin, 1885 (1885), vol. V, p. 129–131. F18–386

FOOD.

Churchill, E. P.: [Food of the oyster.] Appendix VIII, Report, 1919 (1921), p. 19, 35.

Dean, Bashford: [Food of the South Carolina oyster.] Bulletin, 1890 (1892), vol X, p. 345-350.

Everman, Barton Warren: [Experiments in oyster fattening at Lynnhaven, Va.] Report, 1904 (1905). p. 81.

Grave, Caswell: [Oyster food in North Carolina waters.] Report, 1903 (1905), p. 283–292.

Lotsey, Johannes Paulus: The food of oysters, clams, and ribbed mussels. Report, 1893 (1895), p. 375–385, illus. *Doc. 313 issued 1896.* 6–44419

Mitchell, Philip Henry, and Raymond L. Barney: The occurrence in Virginia of green-gilled oysters similar to those of Marennes. (Bibliography: p. 149.) Bulletin, 1915–16 (1918), vol. XXXV. p. 137–149. *Doc. 850 issued Aug. 11, 1917.* F17–247

Moore, Henry Frank: [Food for oysters.] Bulletin, 1897 (1898), vol. XVII, p. 278–279.

——— [Food of the oyster.] Report, 1897 (1898), p. 286–288; also *in* Manual of fish-culture, rev. ed., 1900, p. 286–288.

——— Survey of oyster bottoms in Matagorda Bay, Texas. (Food of the oyster: p. 68–81.) Report, 1905 (1907), 86 p., pl., chart.

——— Volumetric studies of the food and feeding of oysters. Bulletin, 1908 (1910), vol. XXVIII, p. 1295–1308, pl. CXXV, diagrs. *Doc. 719 issued 1910.* 10–35650

Moore, Henry Frank: Condition and extent of the natural oyster beds and barren bottoms of Mississippi Sound, Alabama. (Food: p. 53–54.) Report and special papers, 1911 (1913), 61 p. *Doc. 769 issued Mar. 15, 1913.* F13–48

——— Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. (Food: p. 32–33.) Report and special papers, 1911 (1913), 41 p., VI pl., fold. map. *Doc. 774 issued May 16, 1913.* F13–72

Moore, Henry Frank, and T. E. B. Pope: Oyster-culture experiments and investigations in Louisiana. (Food: p. 43.) Report and special papers, 1908 (1910), 52 p., VIII pl. *Doc. 731 issued May 14, 1910.* 10–35661

Ryder, John Adam: Answers to questions about fattening oysters. Bulletin, 1885 (1885), vol. V, p. 416.

——— [On what does the oyster feed?] Bulletin, 1881 (1882), vol. I, p. 409–410.

——— [Food of the fry and spat.] Report, 1885 (1887), p. 387.

Smeltz, H. A.: [Food of the oyster.] Bulletin, 1897 (1898), vol. XVII, p. 307.

Winslow, Francis: [Food of the embryo.] Report, 1882 (1884), p. 755–756.

ENVIRONMENTAL FACTORS.

Churchill, E. P.: [Factors of environment.] Appendix VIII, Report, 1919 (1921), p. 14.

CURRENTS AND TIDES.

Haskell, E. E.: [Report upon the current observations in Long Island Sound.] Report, 1889–1891 (1893), p. 116–118.

Moore, Henry Frank: [Currents and tides an important factor in oyster culture.] Report, 1897 (1898), p. 284–285; also *in* Manual of fish-culture, rev. ed., 1900, p. 284–285.

——— Survey of oyster bottoms in Matagorda Bay, Texas. (Tides and currents: p. 51–55.) Report and special papers, 1905 (1907), 86 p., pl., chart. *Doc. 610 issued Mar. 6, 1907.* 7–35165

——— Condition and extent of the natural oyster beds of Delaware. (Tides and currents: p. 27.) Report and special papers, 1910 (1911), 29 p. *Doc. 745 issued Feb. 10, 1911.* F11–76

Swift, Franklin: [Currents of Apalachicola Bay.] Report, 1896 (1898), p. 200.

Winslow, Francis: [Currents necessary to successful oyster culture.] Report, 1882 (1884), p. 752.

DENSITY.

Dean, Bashford: [Density of water prevents spat from settling.] Bulletin, 1890 (1892), vol. X, p. 340–344.

Moore, Henry Frank: [Physical factors in the oyster problem.] Bulletin, 1897 (1898), vol. XVII, p. 276–277.

——— [Required density in oyster culture.] Report, 1897 (1898), p. 281–283; also *in* Manual of fish-culture, rev. ed., 1900, p. 281–283.

——— Survey of oyster bottoms in Matagorda Bay, Texas. (Density: p. 57–61.) Report and special papers, 1905 (1907), 86 p., pl., chart.

Netherlands Zoological Station: [Tabular statement of density and temperature of water in the eastern Scheldt.] Report, 1880 (1883), p. 1024–1027.

Ryder, John Adam: [Necessary density of water in oyster culture.] Bulletin, 1884 (1884), vol. IV, p. 19.

——— [Relation of density to hygiana of the oyster.] Report, 1885 (1887), p. 386.

Swift, Franklin: [Density of Apalachicola Bay.] Report, 1896 (1898), p. 199–200.

Winslow, Francis: [Effect of density upon formation of the generative fluids.] Report, 1882 (1884), p. 751–752.

OXYGEN REQUIREMENTS.

Verrill, Addison Emory: How long will oysters live out of water? Bulletin, 1885 (1885), vol. V, p. 161–162. F18–396

Winslow, Francis: [Aeration.] Report, 1882 (1884), p. 753.

SALINITY.

Dean, Bashford: [Density, important factor in oyster culture.] Bulletin, 1891 (1893), vol. XI, p. 359, 365, 367, 371, 382, 390, 402.

Möbius, Karl: [Salinity of water on the coast of Schleswig-Holstein.] Bulletin, 1883 (1883), vol. III, p. 216–217.

Moore, Henry Frank: Condition and extent of the natural oyster beds of Delaware. (Salinity: p. 27.) Report and special papers, 1910 (1911), 29 p. fold. map. *Doc. 745 issued Feb. 10, 1911.* F11–76

Moore, Henry Frank: Condition and extent of the natural oyster beds and barren bottoms of Mississippi Sound, Alabama. (Salinity: p. 52.) Report and special papers, 1911 (1913), 61 p. *Doc. 769 issued Mar. 15, 1913.* F13-48

——— Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. (Salinity: p. 30-32.) Report and special papers, 1911 (1913), 41 p., VI pl., fold. map. *Doc. 774 issued May 16, 1913.* F13-72

Moore, Henry Frank, and Ernest Danglade: Condition and extent of the natural oyster beds and barren bottoms of Lavaca Bay, Texas. (Salinity: p. 39-40.) Appeddix II, Report, 1914 (1915), 45 p. *Doc. 809 issued Feb. 13, 1915.* F15-15

Moore, Henry Frank, and T. E. B. Pope: Oyster-culture experiments and investigations in Louisiana. (Salinity: p. 14, 17, 27, 36, 41.) Report and special paper, 1908 (1910), 52 p., VIII pl. *Doc. 731 issued May 14, 1910.* 10-35661

Ryder, John Adam: [Necessary salinity of water in oyster culture.] Bulletin, 1884 (1884), vol. IV, p. 19.

TEMPERATURE.

Moore, Henry Frank: [Physical characters of the Gulf States favorable to oyster culture.] Bulletin, 1897 (1898), vol. XVII, p. 277.

——— [Temperature an important factor in oyster culture.] Report, 1897 (1898), p. 280-281, also *in* Manual of fish-culture, rev. ed., 1900, p. 280-281.

——— Survey of oyster bottoms in Matagorda Bay, Texas. (Temperature: p. 55-56.) Report and special papers, 1905 (1907), 86 p., pl., chart. *Doc. 610 issued Mar. 6, 1907.* 7-35165

Moore, Henry Frank, and Ernest Danglade: Condition and extent of the natural oyster beds and barren bottoms of Lavaca Bay, Texas. (Temperature: p. 39-40.) Appendix II, Report, 1914 (1915), 45 p. *Doc. 809 issued Feb. 13, 1915.* F15-15

Rasch, H. H.: [Cause of the high temperature of Oyster Lake, Norway.] Report, 1880 (1883), p. 1040-1042.

Ryder, John Adam: [Influence of temperature in oyster culture.] Report, 1885 (1887), p. 387.

Townsend, Charles Haskins: [Temperature of water of San Francisco Bay.] Report, 1889-1891 (1893), p. 345-348.

——— [Temperature of Willapa Bay.] Report, 1895 (1896), p. 198-199.

Winslow, Francis: [Effect of temperature in oyster culture.] Report, 1882 (1884), p. 749-751.

PATHOLOGY AND PATHOLOGICAL CONDITIONS.

DISEASES AND PESTS.

Ryder, John Adam: [Notice of a parasite or commensal of the oyster, with remarks on its distribution.] Bulletin, 1883 (1883), vol. III, p. 292-293.

MORTALITY.

Hall, Ansley: [Fermentation injurious to oysters of New Jersey.] Report, 1892 (1894), p. 476.

Rathbun, R.: [Mortality of oysters in Galveston Bay.] Report, 1893 (1895), p 23-26.

POLLUTION.

Evermann, Barton Warren: [Contamination of oysters at Great South Bay, Long Island.] Report, 1904 (1905), p. 112-113.

Fuller, Cabel Allen: The distribution of sewage in the waters of Narragansett Bay, with special reference to the contamination of the oyster beds. (Bibliography: p. 236-238.) Report, 1904 (1905), p. 189-238. *Doc. 569 issued May 10, 1905.* F10-8

Mitchell, Philip Henry: The effect of water-gas tar on oysters. Bulletin, 1912 (1913), vol. XXXII, p. 199-206. *Doc. 786 issued Feb. 18, 1914.* F14-6

ENEMIES.

Churchill, E. P.: [Protection against enemies.] Appendix VIII, Report, 1919 (1921), p. 36.

Collins, J. W.: [Unfavorable conditions, enemies, etc., of the oysters of Connecticut.] Bulletin, 1889 (1891), vol. IX, p. 482-485.

Danglade, Ernest: The flatworm as an enemy of Florida oysters. Appendix V, Report, 1918 (1920), 8 p., II pl. *Doc. 869 issued June 20, 1919.* F19-30

Dean, Bashford: [Messmates and enemies.] Bulletin, 1890 (1892), vol. X, p. 351-352.

Depredations to oyster beds by starfish. Bulletin, 1884 (1884), vol. IV, p. 138. F18-247

Garman, Samuel: Protecting the oyster beds from starfish depredations. Bulletin, 1885 (1885), vol. V, p. 127-129. F18-385

Grave, Caswell: [Bucephalus an enemy of oysters.] Report, 1903 (1905), p. 270-271.

Hall, Ansley: [Enemies of the oyster.] Report, 1892 (1894), p. 476.

Hausser, A. E.: [Enemies of the oyster; crabs, murex periwinkle, rays, shrimp, starfish, seaworm.] Report, 1880 (1883), p. 978-981.

Hoek, P. P. C.: [Occurrence of the "drill" (Murex) in oysters imported into the Netherlands.] Report, 1880 (1883), 1021-1023.

Horst, R.: [Actiniæ, a possible enemy of the oyster.] Bulletin, 1882 (1883), vol. II, p. 165-166.

Martin, S. J.: [Starfish depredations.] Bulletin, 1885 (1885), vol. V, p. 77.

Moore, Henry Frank: [Enemies of oysters.] Bulletin, 1897 (1898), vol. XVII, p. 279.

——— [Enemies of oysters.] Report, 1897 (1898), p. 288-291; also *in* Manual of fish-culture, rev. ed., 1900, p. 289-291.

——— [Destructive agencies. The conch, drumfish, ray, stone crab, boring sponge, boring clam, algæ.] Report, 1898 (1899), p. 91-95.

——— Survey of oyster bottoms in Matagorda Bay, Texas. (Enemies of the oyster: p. 63-68.) Report and special papers, 1905 (1907), 86 p., pl., chart. *Doc. 610 issued Mar. 6, 1907.* 7-35165

——— Condition and extent of the natural oyster beds of Delaware. (Enemies: p. 28-29.) Report and special papers, 1910 (1911), 29 p. *Doc. 745 issued Feb. 10, 1911.* F11-76

——— Condition and extent of the natural oyster beds and barren bottoms of Mississippi Sound, Alabama. (Enemies: p. 54-56.) Report and special papers, 1911 (1913), 61 p. *Doc. 769 issued Mar. 15, 1913.* F13-48

——— Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. (Enemies: p. 33-34.) Report and special papers, 1911 (1913), 41 p., VI pl., fold. map. *Doc. 774 issued May 16, 1913.* F13-72

Moore, Henry Frank, and Ernest Danglade: Condition and extent of the natural oyster beds and barren bottoms of Lavaca Bay, Texas. (Enemies: p. 41-42.) Appendix II, Report, 1914 (1915), 45 p. *Doc. 809 issued Feb. 13, 1915.* F15-15

Moore, Henry Frank, and T. E. B. Pope: Oyster culture experiments and investigations in Louisiana. (Porpura: p. 23-27.) Report and special papers, 1908 (1910), 52 p., VIII pl. *Doc. 731 issued May 14, 1910.* 10-35661

Rathbun, Richard: [Injury to oyster beds by drills and starfish.] Report, 1888-89 (1892), p. LXI.

——— [Injury to oyster beds in Long Island Sound by starfish.] Report, 1889-1891 (1893), p. 112-115.

Renaud, J.: [Protecting oysters from their enemies.] Report, 1880 (1883), p. 936-941.

Rowe, Henry C.: [Enemies of the oyster.] Bulletin, 1893 (1894), vol. XIII, p. 275.

Ruge, John G.: [Enemies of oysters.] Bulletin, 1897 (1898), vol. XVII, p. 293.

Ryder, John Adam: [Enemies of oysters.] Bulletin, 1883 (1883), vol. III, p. 289.

Smith, Hugh McCormick: [Enemies of the oysters in Louisiana.] Report, 1898 (1899), p. CXXIV.

——— [Inquiry regarding destruction of oysters by drumfish.] Report, 1902 (1904), p. 123-124.

Townsend, Charles Haskins: [Enemies of the oyster: sting ray, drill, starfish.] Report, 1889-91 (1893), p. 348-350.

U. S. Commissioner of Fisheries: [Oyster enemies.] Report, 1911 (1913), p. 20.

ABNORMAL COLORATION.

GREEN.

Coste, Jean Jacques Marie Cyprian Victor: [Green oysters of Marenne.] Report, 1880 (1883), p. 834-845.

Dean, Bashford: [Greening oysters in *claires*.] Bulletin, 1890 (1892), vol. X, p. 378-380.

Grave, Caswell: [Greengill oysters in Goose Creek Bay, N. C.] Report, 1903 (1905), p. 274-275.

Hall, Ansley: [Green oysters in New Jersey in 1892.] Report, 1892 (1894), p. 487-489.

Hausser, A. E.: [Cause of green oysters in Morbihan.] Report, 1880 (1883), p. 987-988.

Mitchell, Philip Henry, and Raymond L. Barney: The occurrence in Virginia of green-gilled oysters similar to those of Marennes. (Bibliography: p. 149.) Bulletin, 1915-16 (1918), p. 135-150. *Doc. 850 issued Aug. 11, 1917.* F17-247

Moore, Henry Frank: [Green color of oysters.] Report, 1897 (1898), p. 337; also *in* Manual of fish-culture, rev. ed., 1900, p. 337.

Nelson, Julius: [Cause of viridity of New Jersey oysters.] *Quoted by* Hall. Report, 1892 (1894), p. 489-490.

Puységur, M., and John A. Ryder: [On the cause of the greening of oysters, by M. Puységur, with a supplementary note on the coloration of the blood-corpuscles of the oyster, by John A. Ryder.] Report, 1882 (1884), p. 793-805.

Ryder, John Adam: [Cause of green coloration.] Bulletin, 1881 (1882), vol. I, p. 410-419.

——— [Popular delusion regarding green-gilled oysters.] Bulletin, 1883 (1883), vol. III, p. 294.

——— [Green oysters.] Report, 1885 (1887), p. 420-421.

Smith, Hugh McCormick: [Green-gill oysters of the Chesapeake Bay.] Report, 1898 (1899), p. CXXVII-CXXVIII.

RED.

Smith, Hugh McCormick: [Peridenium as a possible cause.] Report, 1898 (1899), p. CXXVIII-CXXIX.

EMBRYOLOGY.

Bouchon-Brandely, Germain: Report relative to the generation and artificial fecundation of oysters, addressed to the minister of the marine and the colonies. (Tr. with notes, by John A. Ryder.) Bulletin, 1882 (1883), vol. II, p. 316-338. F12-366

——— On the sexuality of the common oyster (*O. edulis*) and that of the Portuguese oyster (*O. angulata*). Artificial fecundation of the Portuguese oyster. (Tr. by John A. Ryder.) Bulletin, 1882 (1883), vol. II, p. 339-341. F12-367

——— Report on the artificial fecundation and generation of oysters. Bulletin, 1886 (1887), vol. VI, p. 223-240, pl. II-V. F18-584

Brooks, W. K.: [Embryonic development of the oyster.] *Quoted by* Moore. Report, 1897 (1898), p. 270-272; also *in* Manual of fish-culture, rev. ed., 1900, p. 271-272.

Churchill, E. P.: [Embryology of oyster.] Appendix VIII, Report, 1919 (1921), p. 12.

Colson, C. Bunting: [Spawning season of the raccoon oyster.] Bulletin, 1890 (1892), vol. X, p. 352.

Hoek, Paulus Peronius Cato: Researches on the generative organs of the oyster (*O. edulis*). Bulletin, 1882 (1883), vol. II, p. 343-345. F12-369

——— Comparative examination of cultivated and uncultivated oysters, with a view to determine the number which, during the first year, took part in reproduction. Bulletin, 1885 (1885), vol. V, p. 193-196. F18-406

Horst, Rutger: A contribution to our knowledge of the development of the oyster (*Ostrea edulis* L.). (Tr. by J. A. Ryder.) Bulletin, 1882 (1883), vol. II, p. 159-167, illus. F12-355

——— The development of the oyster (*Ostrea edulis* L.). Report, 1884 (1886), p. 891-911, II pl. F17-136

Huxley, Thomas H.: [Embryonic development of the oyster.] *Quoted by* Moore. Report, 1897 (1898), p. 272-273; also *in* Manual of fish-culture, rev. ed., 1900, p. 272-273.

Laurent, Pierre: [Report on experiments at fecundation.] Bulletin, 1886 (1887), vol. VI, p. 228-240.

Möbius, Karl August: [Reproduction of the oyster.] Report, 1880 (1883), p. 692-696.

Moore, Henry Frank: [Reproduction and development of the oyster.] Report, 1897 (1898), p. 267-280; also *in* Manual of fish-culture, rev. ed., 1900, p. 267-280.

——— [Anatomy, embryology, and growth of the oyster.] Report, 1903 (1905), p. 317-327 incl. tables, illus., pls.

——— Survey of oyster bottoms in Matagorda Bay, Texas. (Spawning of the oyster: p. 81-82.) Report and special papers, 1905 (1907), 86 p., pl., chart. *Doc. 610 issued Mar. 6, 1907.* 7-35165

Ryder, John Adam: Notes on the breeding, food, and green color of the oyster. Bulletin, 1881 (1882), vol. I, p. 403-419. F12-339

——— The microscopic sexual characteristics of the American, Portuguese, and common oyster of Europe compared. Bulletin, 1882 (1883), vol. II, p. 205-215. F12-358

——— On mode of fixation of the fry of the oyster. Bulletin, 1882 (1883), vol. II, p. 383-397, illus. F12-376

——— Rearing oysters from artificially fertilized eggs, together with notes on pond culture. Bulletin, 1883 (1883), vol. III, p. 281-294. F18-137

——— A contribution to the life-history of the oyster. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. IV, p. 711-758.

Ryder, John Adam: [Artificial fertilization.] Report, 1885 (1887), p. 385, 399–400.

Ryder, John Adam, and M. Puységur: Papers on the development and greening of the oyster. (*Contents.*—1. An account of experiments in oyster culture and observations relating thereto, by Ryder. 2. On the cause of the greening of oysters, by Puységur, with a supplementary note on the coloration of the blood corpuscles of the oyster, by Ryder.) Report, 1882 (1884), p. 763–805, illus. *Doc. 91 issued Feb. 7, 1885.* F11–304

ANATOMY

Brooks and Ryder: [Anatomy of the oyster.] *Quoted by* Moore. Report, 1897 (1898), p. 276–279, pl.; also *in* Manual of fish-culture, rev. ed., 1900, p. 276–279, pl.

——— [Anatomy of the oyster.] *Quoted by* Moore. Report, 1903 (1905), p. 317–327 incl. tables, illus., pls.

Churchill, E. P.: [Anatomy of the oyster.] Appendix VIII, Report, 1919 (1921), p. 9.

Hoek, Paulus Peronius Cato: Researches on the generative organs of the oyster (*O. edulus*). Bulletin, 1882 (1883), vol. II, p. 343–345. F12–369

Ryder, John A.: Preliminary notice of some points in the minute anatomy of the oyster. Bulletin, 1882 (1883), vol. II, p. 135–137. F12–352

——— The microscopic characteristics of the American, Portuguese, and common edible oyster of Europe compared. Bulletin, 1882 (1883), vol. II, p. 205–215. F12–358

——— Note on the organ of Bojanus in *Ostrea virginica* Gmelin. Bulletin, 1882 (1883), vol. II, p. 345–347. F12–370

CULTURE.

GENERAL.

Brooks, W. K.: On the artificial propagation and cultivation of oysters in floats. Bulletin, 1886 (1887), vol. VI, p. 443–445. F18–627

Buch, S. A.: Oyster-culture as seen at the London fisheries exposition. Report, 1884 (1886), p. 913–923. F17–137

Fraiche, Félix: A practical guide to oyster-culture, and methods of rearing and multiplying edible marine animals. Report, 1880 (1883), p. 753–824, illus. F16–281

Hall, Ansley: Notes on the oyster industry of New Jersey. Report, 1892 (1894), p. 463–528. F14–44

Horst, R.: The development of the oyster (*Ostrea edulis* L.). Report, 1884 (1886), p. 891–911. F17–136

Mather, F.: [Oyster culture in a wooden tank.] Bulletin, 1885 (1885), vol. V, p. 466.

Mitchell, P. H.: Nutrition of oysters; glycogen formation and storage. Bulletin, 1915–16 (1918), vol. XXXV, p. 153–161. *Doc. 851 issued Apr. 11, 1917.* F17–248

——— Nutrition of oysters; the nature of the so-called "fattening" of oysters. Bulletin, 1915–16 (1918), vol. XXXV, p. 479–483. *Doc. 860 issued Mar. 13, 1918.* F18–514

Möbius, Karl: The oyster and oyster-culture. Report, 1880 (1883), p. 683–751, illus. F16–293

Moore, Henry Frank: Oysters and methods of oyster-culture. Report, 1897 (1898), p. 265–338, illus., XVIII pl. *Doc. 349 issued Nov. 13, 1897.* Also *in* Manual of fish-culture, rev. ed. 1900, p. 263–338.

Pierce, H. H.: Some of the difficulties which confront oyster breeders. Bulletin, 1884 (1884), vol. IV, p. 332–333. F18–324

Ryder, John Adam: Notes on the breeding, food, and green color of the oyster. Bulletin, 1881 (1882), vol. I, p. 403–419. F12–329

——— On the mode of fixation of the fry of the oyster. Bulletin, 1882 (1883), vol. II, p. 383–387, illus. F12–376

——— Rearing oysters from artificially fertilized eggs, together with notes on pond culture. Bulletin, 1883 (1883), vol. III, p. 281–294. F18–137

——— On a new form of filter or diaphragm to be used in the culture of oysters in ponds. Bulletin, 1884 (1884), vol. IV, p. 17–31. F13–78

——— Floats for the so-called fattening of oysters. Bulletin, 1884 (1884), vol. IV, p. 302–304. F18–320

——— [An account of experiments in oyster-culture and observations relating thereto (second series).] Report, 1882 (1884), p. 763–778.

——— An exposition of the principles of a rational system of oyster-culture, together with an account of a new and practicable method of obtaining oyster spat in a scale of commercial importance. Report, 1885 (1887), p. 381–423, IV pl. *Doc. 104 issued Sept. 1, 1886.* F11–249

Ryder, John Adam, and R. M. Bache: On apparatus for collecting oyster spat. Bulletin, 1884 (1884), vol. IV, p. 373-375. F18-335

Solomon, John I.: A process for preserving the pearl-oyster fisheries and for increasing the value of the yield of pearls. Bulletin, 1908 (1910), vol. XXVIII, p. 303-313, diagrs, *Doc. 660 issued 1910.* 10-35154

Winslow, Francis: Memorandum of the present condition and future needs of the oyster industry. Bulletin, 1884 (1884), vol. IV, p. 233-234. F13-101

——— Notes upon oyster experiments in 1883. Bulletin, 1884 (1884), vol. IV, p. 354-356. F18-332

UNITED STATES.

GENERAL.

Broca, P. de: [Oyster culture in the United States.] Report, 1873-74 and 1874-75 (1876), p. 296-299.

Churchill, E. P.: The oyster and the oyster industry of the Atlantic and Gulf coasts. (Bibliography. p. 50.) Appendix VIII, Report, 1919 (1921), 51p., illus., XXIX pl. *Doc. 890 issued Oct. 12, 1920.* F20-167

Rathbun, Richard: [Production of seed oysters.] Report, 1892 (1894), p. CVI.

ALABAMA.

Delchamps, John J.: [Notes respecting oysters of Mobile Bay and sound in Mobile County, Alabama.] Bulletin, 1895 (1896), vol. XV, p. 339.

Moore, Henry Frank: Condition and extent of the natural oyster beds and barren bottoms of Mississippi Sound, Alabama. Report and special papers, 1911 (1913), 61 p., illus., V pl., fold. chart. *Doc. 769 issued Mar. 15, 1913.* F13-48

Ritter, Homer P.: Report of a reconnoissance of the oyster beds of Mobile Bay and Mississippi Sound, Alabama. Bulletin, 1895 (1896), vol. XV, p. 325-340, pl. 36-63 (partly fold.). *Doc. 305 issued Apr. 11, 1896.* F12-247

ALASKA.

Stearns, R. E. C.: Transportation of clams and oysters. Bulletin, 1884 (1884), vol. IV, p. 219-220. F18-289

CALIFORNIA.

Gilbert, Charles Henry: Report upon certan investigations relating to the planting of oysters in southern California. Bulletin, 1889 (1891), vol IX, p. 95-98, pl. 31-34 (partly fold.). *Doc. 153 issued July 11, 1891.* F12-141

Moore, H. F.: [Eastern oysters on the Pacific coast.] Report, 1900 (1901), p. 120-121.

Rathbun, Richard: [Introduction of oysters in San Francisco Bay.] Report, 1888 (1892), p. LV.

——— [Oyster investigation, San Francisco Bay.] Report, 1889 (1893), p. 107-108.

Stearns, R. E. C.: Transportation of clams and oysters. Bulletin, 1884 (1884), vol. IV, p. 219-220. F18-289

CONNECTICUT.

Rowe, Henry C.: Deep-water oyster culture. Bulletin, 1893 (1894), vol. XIII, p. 273-276. *Doc. 264 issued June 9, 1894.* F12-183

Winslow, Francis: Report of experiments in the artificial propagation of oysters, conducted at Beaufort, N. C., and Fair Haven, Conn., in 1882. Report, 1882 (1884), p. 741-761, pl. F16-320

DELAWARE.

Moore, Henry Frank: Condition and extent of the natural oyster beds of Delaware. Report and special papers, 1910 (1911), 29 p., fold. map. *Doc. 745 issued Feb. 10, 1911.* F11-76

FLORIDA.

Detwiler, John Y.: [Experimental oyster culture.] Bulletin, 1897 (1898), vol. XVII, p. 311.

Poincy, J. W. de: Description of a fish-trap and oyster basin. Bulletin, 1885 (1885), vol. V, p. 134. F18-389

Smeltz, H. A.: The oyster bars of the west coast of Florida, their depletion and restoration. Bulletin, 1897 (1898), vol. XVII, p. 305-308. *Doc. 385 issued Aug. 8, 1898.* F12-110

Swift, Franklin: The oyster-grounds of the west Florida coast: their extent, condition, and peculiarities. Bulletin, 1897 (1898), vol. XVII, p. 285-287. *Doc. 382 issued Aug. 8, 1898.* F12-110

Swift, Franklin: Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George Sound, Florida. Report, 1896 (1898), p. 187–221, pl. 22. *Doc. 343 issued 1897.* F11–178

GEORGIA.

Oemler, A.: The past, present, and future of the oyster industry of Georgia. Bulletin 1893 (1894), vol. XIII, p. 262–272. *Doc. 264 issued June 9, 1894.* F12–183

LOUISIANA.

Moore, Henry Frank: Report on the oyster beds of Louisiana. Report, 1898 (1899), p. 45–100. *Doc. 402 issued Mar. 22, 1899.* F11–114

Moore, Henry Frank, and T. E. B. Pope: Oyster culture experiments and investigations in Louisiana. Report and special papers, 1908 (1910), 52 p., VIII pl. *Doc. 731 issued May 14, 1910.* 10–35661

U. S. Bureau of Fisheries: [Louisiana oyster work.] Report, 1908 (1910), p. 9, 1909 (1911), p. 13.

Zacharie, F. C.: [Manners of cultivation of the Louisiana oyster.] Bulletin, 1897 (1898), vol. XVII, p. 298–299.

MARYLAND.

Pierce, H. H.: Some of the difficulties which confront oyster breeders. Bulletin, 1884 (1884), vol. IV, p. 332–333. F18–324

Ravenel, William de Chastignier: [Results of oyster experiments at St. Jerome in 1884.] Bulletin, 1885 (1885), vol. V, p. 73.

——— [Report of operations at St. Jerome station.] Report, 1884 (1886), p. 209–214; 1885 (1887), p. 165–183; 1886 (1889), p. 765–777.

Ryder, John Adam: Journal of operations on the grounds of the Eastern Shore oyster company, on Chincoteague Bay, near Stockton, Md., during the summer of 1883. Bulletin, 1884 (1884), vol. IV, p. 43–47. F18–211

——— Report respecting the present condition and future prospects at St. Jerome Creek for the work of oyster culture. Bulletin, 1884 (1884), vol. IV, p. 235–237. F13–102

Stevenson, Charles Hugh: The oyster industry of Maryland. (Historical notes; p. 251–260.) Bulletin, 1892 (1894), vol. XII, p. 203–297, pl. 56–71. *Doc. 227 issued Feb. 28, 1894.* F12–165

U. S. Commissioner of Fisheries: [Experiments in oyster culture at St. Jerome.] Report, 1882 (1884), p. LXXXIV; 1883 (1885), p. LXXXIX–XCII; 1884 (1886), p. LXV; 1885 (1887), p. C; 1886 (1889), p. XXXIX.

Wood, William Maxwell: Report of operations at Saint Jerome station, in laying out oyster ponds, by steamer *Fish Hawk*, Report, 1883 (1885), p. 1153–1156, tables. F17–42

MASSACHUSETTS.

Gunnison, James W.: [Oyster culture in northern Massachusetts.] Bulletin, 1885 (1885), vol. V, p. 77.

U. S. Commissioner of Fisheries: [Experiments in oyster culture at Woods Hole.] Report, 1884 (1886), p. LXV.

MISSISSIPPI.

Moore, Henry Frank: Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. Report and special papers, 1911 (1913), 41 p., pl., fold. map. *Doc. 774 issued May 16, 1913.* F12–72

NEW JERSEY

Hall, Ansley: Notes on the oyster industry of New Jersey. Report, 1892 (1894), p. 463–528 incl. tables. *Doc. 291 issued Dec. 19, 1894.* F14–44

Ryder, John A.: [Experiments in oyster culture at Sea Island City.] Report, 1893 (1895), p. 26–28.

NEW YORK.

Blackford, Eugene G.: Report on an oyster investigation in New York with the steamer *Lookout*. Report, 1885 (1887), p. 157–163. F17–143

Bunce, Henry C.: [Oyster culture at Cold Spring Harbor, New York.] Bulletin, 1885 (1885), vol. V, p. 73.

NORTH CAROLINA.

Grave, Caswell: Investigations for the promotion of the oyster industry in North Carolina. (*Contents*—Investigations for the promotion of the oyster industry of North Carolina, by C. Grave. Anatomy, embryology, and growth of the oyster, by H. F. Moore. Observations and experiments on the growth of oysters, by O. C. Glaser.) Report, 1903 (1905), p. 247–341, XI (*i. e.* X) pl., fold. map. *Doc. 556 issued Feb. 2, 1905.* F11–12

Winslow, Francis: Report of experiments in the artificial propagation of oysters, conducted at Beaufort, N. C., and Fair Haven, Conn., in 1882. Report, 1882 (1884), p. 741–761, pl. F16–320

RHODE ISLAND.

Pettis, Robert: [The time of spawning of oysters in Rhode Island.] Bulletin, 1885 (1885), vol. V, p. 348.

SOUTH CAROLINA.

Battle, John D.: An investigation of the coast waters of South Carolina, with reference to oyster culture. Bulletin, 1890 (1892), vol. X, p. 303–330, pl. LIV–LX. *Doc. 199 issued Nov. 2, 1892.* F12–118

Dean, Bashford: The physical and biological characteristics of the natural oyster grounds of South Carolina. Bulletin, 1890 (1892), vol. X, p. 335–361, pl. LXII–LXVIII. *Doc. 202 issued Dec. 19, 1892.* F12–121

TEXAS.

Kibbe, I. P.: Oysters and oyster culture in Texas. Bulletin, 1897 (1898), vol. XVII, p. 313–314. *Doc. 387 issued 1898.* F12–110

Moore, B. V.: [Proposed oyster planting in a salt lake in Texas.] Bulletin, 1885 (1885), vol. V, p. 73.

Moore, Henry Frank: Survey of oyster bottoms in Matagorda Bay, Texas. Report and special papers, 1905 (1907), 86 p., XIII pl., fold. map. *Doc. 610 issued Mar. 6, 1907.* 7–35165

Moore, Henry Frank, and Ernest Danglade: Condition and extent of the natural oyster beds and barren bottoms of Lavaca Bay, Texas. Appendix II, Report, 1914 (1915), 45 p. *Doc. 809 issued Feb. 13, 1915.* F15–15

Stevenson, Charles Hugh: [Oyster culture in Texas.] Report, 1889–1891 (1893), p. 391–393.

VIRGINIA.

Evermann, Barton Warren: [Oyster fattening experiments at Lynnhaven.] Report, 1904 (1905), p. 81–83.

Moore, Henry Frank: Condition and extent of the oyster beds of the James River, Virginia. Report and special papers, 1909 (1911), 83 p., fold. charts. *Doc. 729 issued 1910.* 10–35064

Smith, Hugh M.: [Report on oyster fattening experiments at Lynnhaven.] Report, 1897 (1898 p),. CIII; 1898, (1899), p. CXXV; 1899 (1900), p. CXXXI–CXXXII; 1900 (1901), p. 119; 1901 (1902), p. 121–122; 1902 (1904), p. 120–123; 1903 (1905), p. 75.

U. S. Bureau of Fisheries: [Artificial method of fattening oysters at Lynnhaven.] Report, 1905 (1907), p. 21–22; 1906 (1908), p. 12; 1907 (1909), p. 10; 1908 (1910), p. 9; 1909 (1911), p. 13; 1910 (1911), p. 16.

WASHINGTON.

Rathbun, Richard: [Oyster investigations and experiments in Willapa Bay.] Report, 1895 (1896), p. 84–86.

Townsend, Charles Haskins: The transplanting of eastern oysters to Willapa Bay, Washington, with notes on the native oyster industry. Report, 1895 (1896), p. 193–202, pl. *Doc. 334 issued Jan. 6, 1897.* F11–197

PACIFIC COAST.

Townsend, Charles Haskins: Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. Report, 1889–1891, (1893), p. 343–372, pl. 2–11 (part. fold.) *Doc. 217 issued Nov. 13, 1893.* F16–84

EUROPE.

GENERAL.

Dean, Bashford: Report on the European methods of oyster culture. Bulletin, 1891 (1893), vol. XI, p. 357–406, illus., pl. LXXV–LXXXVIII. *Doc. 214 issued July 14, 1893.* F12–156

——— [European methods of oyster culture.] Report, 1893 (1895), p. 30–32.

Rathbun, Richard: [Proposed study of European oyster culture.] Report, 1889-1891 (1893), p. 124–125.

BELGIUM.

Dean, Bashford: [Oyster culture in Belgium.] Bulletin, 1891 (1893), vol. XI, p. 389–392.

ENGLAND.

Dean, Bashford· [Oyster culture in England.] Bulletin, 1891 (1893), vol. XI, p. 393–401.

FRANCE.

Bouchon-Brandely, Germain: Report to the minister of marine relative to oyster culture upon the shores of the British channel and the ocean. (Tr. by Marshall McDonald.) Report, 1882 (1884), p. 673–724. F16–309

Brocchi, Paul: Report on the condition of oyster culture in France in 1881. Report, 1882 (1884), p. 725–739. F16–310

——— Report on the condition of oyster culture in France in 1881. Bulletin, 1884 (1884), vol. IV, p. 97–111. F13–86

Coste, Jean Jacques Marie Cyprien Victor: Report on the oyster and mussel industry of France and Italy. Report, 1880 (1883), p. 825–883, XIII pl. F16–277

Dean, Bashford: Report on the present methods of oyster culture in France. (List of works relating to French oyster culture; p. 385–388.) Bulletin, 1890 (1892), vol. X, p. 363–388, illus., pl. LXVIII–LXXVIII. *Doc. 203 issued Dec. 19, 1892.* F12–122

De Bon: Report on the condition of oyster culture in 1875, preceded by a report to the minister of marine and the colonies. Report, 1880 (1883), p. 885–906. F16–278

Fraiche, Félix: A practical guide to oyster culture, and the methods of rearing and multiplying edible marine animals. Report, 1880 (1883), p. 753–824, illus. F16–281

Hausser, A. E.: Oyster culture in Morbihan. A report prepared in the name of the commission of the competitive exhibition of Vannes. Report, 1880 (1883), p. 943–999, illus. F16–286

Möbius, Karl August: [Oyster culture in France.] Report, 1880 (1883), p. 698–707, illus.

Rathbun, Richard: [French methods of oyster culture.] Report, 1892 (1894), p. CXXI–CXXIII.

Renaud, J.: An account of the Portuguese and French oysters cultivated in the Bay of Arcachon. Report, 1880 (1883), p. 931–941, illus. F16–304

GERMANY.

Borne, Max von dem: [Canadian oysters planted in the Baltic.] Bulletin, 1885 (1885), vol. V, p. 261.

Dean, Bashford: [Oyster culture in Germany.] Bulletin, 1891 (1893), vol. XI, p. 370–380, illus.

Möbius, Karl August: How can the cultivation of the oyster, especially on the German coasts, be made permanently profitable? Report, 1877 (1879), p. 875–884. F16–124

——— Report on planting Canadian oysters, near the island of Aaroe, in the Little Belt, November 6, 1884. Bulletin, 1885 (1885), vol. V, p. 257–260. F18–427

Rumpff, Carl: The oyster as a popular article of food in North America. Bulletin, 1884 (1884), vol. IV, p. 356–358. F18–333

HOLLAND.

Dean, Bashford: [Oyster culture in Holland.] Bulletin, 1891 (1893), vol. XI, p. 381–388.

ITALY.

Bouchon-Brandely, Germain: A report on oyster culture in the Mediterranean. Report, 1880 (1883), p. 907–930. F16–275

Coste, Jean Jacques Marie Cyprien Victor: [Artificial oyster beds of Lake Tusaro.] Report, 1880 (1883), p. 825–834.

Dean, Bashford: [Oyster culture in Italy.] Bulletin, 1891 (1893), vol. XI, p. 358–366.

Ninni, Alexander P.: Fish and oyster culture in the province of Venice. Bulletin, 1886 (1887), vol. VI, p. 177–186. F18–567

NETHERLANDS.

Hoek, Paulus Peronius Cato: Oyster cultivation in the Netherlands. Report, 1880 (1883), p. 1029–1035. F16–287

Nederlandsche Comm. voor het Zoöligsch Station: Results of the investigations relative to the oyster and its cultivation at the end of the first year of these investigations. Report, 1880 (1883), p. 1001–1027. F16–297

NORWAY.

Rasch, Halvor Heyerdahl: On the reason for an extraordinarily rich production of oysters in a natural basin. Report, 1880 (1883), p. 1037–1043. F16–294

PORTUGAL.

Dean, Bashford: [Oyster culture in Portugal.] Bulletin, 1891 (1893), vol. XI, p. 366–370.

SPAIN.

Dean, Bashford: [Oyster culture in Spain.] Bulletin, 1891 (1893), vol. XI, p. 366–370.

MEDITERRANEAN.

Bouchon-Brandely, Germain: A report on oyster culture in the Mediterranean. Report, 1880 (1883), p. 907–930. F16–275

BALTIC.

Möbius, Karl August: On experiments, begun in 1880, to plant American oysters in the western Baltic, and the usefulness of continuing these experiments, with the aid of the German fishery association. Bulletin, 1883 (1883), vol. III, p. 213–217. F12–383

JAPAN.

Dean, Bashford: Japanese oyster culture. Bulletin, 1902 (1904), vol. XXII, p. 17–38, illus., pl. 3–7. *Doc. 512 issued Feb. 17, 1903.* F12–56

Mitsukuri, Kakichi: [Cultivation of the oyster in Japan.] Bulletin, 1904 (1905), vol. XXIV, p. 278–284, illus. XI pl.

OCEANICA.

HAWAII.

Colburn, John F.: [Oyster culture in Hawaii.] *Quoted by* J. F. Moser. Report, 1897 (1898), p. CLXX.

NEW ZEALAND.

Sneed, William: [Oyster culture in New Zealand.] Bulletin, 1886 (1887), vol. VI, p. 213.

ACCLIMATIZATION.

Collins, Joseph William: [First attempt at planting oysters on the Pacific coast.] Report, 1888-89 (1892), p. 154–155.

Möbius, Karl: Report on planting Canadian oysters near the island of Aaroe, in the Little Belt, November 6, 1884. Bulletin, 1885 (1885), vol. V, p. 257–260. F18–427

Townsend, Charles Haskins: Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. Report, 1889–1891 (1893), p. 343–372, pl. II–XI (part. fold.). *Doc. 217 issued Nov. 13, 1893.* F16–84

——— The transplanting of eastern oysters to Willapa Bay, Washington, with notes on the native oyster industry. Report, 1895 (1896), p. 193–202, pl. *Doc. 334 issued Jan. 6, 1897.* F11–197

Washburn, F. L.: [Observations on transplanted eastern oysters.] *Quoted by* H. M. Smith. Report, 1898 (1899), p. CXXVI–CXXVII.

FISHERIES.

GENERAL.

Goode, G. Brown: The oyster industry of the world. Bulletin, 1884 (1884), vol. IV, p. 468–469. F18–363

Verrill, Addison Emory: How long will oysters live out of water? Bulletin, 1885 (1885), vol. V, p. 161–162. F18–396

UNITED STATES.

Broca, P. de: On the oyster industries of the United States. Report, 1873–74 and 1874–75 (1876), p. 271–319. F16–17

Churchill, E. P.: The oyster and the oyster industry of the Atlantic and Gulf coasts. (Bibliography: p. 50.) Appendix VIII, Report, 1919 (1921), 51 p., illus., XXIX pl. *Doc. 890 issued Oct. 12, 1920.* F20–167

Ingersoll, Ernest: The oyster, scallop, clam, mussel, and abalone industries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XX, p. 505–626.

Moore, Henry Frank: Some factors in the oyster problem. Bulletin, 1897 (1898), vol. XVII, p. 275–284. *Doc. 381 issued Aug. 8, 1898.* F12–110

Rathbun, Richard: [Oyster industry of the Atlantic coast.] Report, 1888–89 (1892), p. LIX–LXV.

Smith, Hugh McCormick: [Oyster fishery of the United States.] Report, 1892 (1894), p. CLXXVIII–CLXXX.

——— [Inquiries and experiments relative to the oyster fisheries.] Report, 1897 (1898), p. CIII–CV.

Stevenson, Charles Hugh: [Origin and extent of export of oysters from the United States.] Report, 1894 (1896), p. 515–519.

U. S. Bureau of Fisheries: [Oyster investigations.] Report, 1910 (1911), p. 15–16; 1913 (1914), p. 27–28.

——— [U. S. oyster industry.] Report, (1913), p. 7–23; 1913 (1914), p. 40–49.

U. S. Commissioner of Fisheries: [Value of the oyster fisheries of the United States.] Report, 1899 (1900), p. VII–VIII.

ALABAMA.

Moore, Henry Frank: Condition and extent of the natural oyster beds and barren bottoms of Mississippi Sound, Alabama. Report and special papers, 1911 (1913), 61 p., illus., V pl., fold. chart. *Doc. 769 issued Mar. 15, 1913.* F13–48

Ritter, Homer P.: Report of a reconnoissance of the oyster beds of Mobile Bay and Mississippi Sound, Alabama. Bulletin, 1895 (1896), vol. XV, p. 325–339, pl. 56–63 (partly fold.). *Doc. 305 issued Apr. 11, 1896.* F12–247

U. S. Commissioner of Fisheries: [Survey of the natural oyster beds of Alabama.] Report, 1911 (1912), p. 19.

ALASKA.

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1909. (Rock oyster: p. 53.) Report and special papers, 1909 (1911), 58 p. *Doc. 730 issued Apr. 20, 1910.* 7–35263

CALIFORNIA.

Gilbert, Charles Henry: Report upon certain investigations relating to the planting of oysters in southern California. Bulletin, 1889 (1891), vol. IX, p. 95–98, pl. 31–34 (partly fold.). *Doc. 153 issued July 11, 1891.* F12–141

Townsend, Charles Haskins: Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. Report, 1889-1891 (1893), p. 343-372, pl. 2-11 (partly fold.). *Doc. 217 issued Nov. 13, 1893.* F16-84

——— [Eastern oysters in San Francisco Bay.] Report, 1900 (1901), p. 179.

Wilcox, William A.: [Oyster fisheries of San Francisco.] Report, 1893 (1895), p. 206-208.

CONNECTICUT.

Collins, J. W.: Notes on the oyster fishery of Connecticut. Bulletin, 1889 (1891), vol. IX, p. 461-497, pl. CLIX-CLXVI. *Doc. 169 issued Aug. 27, 1891.* F12-155

DELAWARE.

Moore, Henry Frank: Condition and extent of the natural oyster beds of Delaware. Report and special papers, 1910 (1911), 29 p., fold. map. *Doc. 745 issued Feb. 10, 1911.* F11-76

U. S. Bureau of Fisheries: [Survey of the natural oyster beds.] Report, 1911 (1913), p. 18-19.

Winslow, Francis: Memorandum of the present condition and future needs of the oyster industry. Bulletin, 1884 (1884), vol. IV, p. 233-234. F13-101

FLORIDA.

Collins, Joseph William: [Pensacola oyster fishery.] Report, 1885 (1887), p. 302-303.

Danglade, Ernest: Condition and extent of the natural oyster beds and barren bottoms in the vicinity of Apalachicola, Fla. Appendix V, Report, 1916 (1917), 68 p. incl. tables, VII pl., fold. chart. *Doc. 841 issued Mar. 22, 1917.* F17-156

Detwiler, John Y.: Notes on the fishing industry of eastern Florida. Bulletin, 1897 (1898), vol. XVII, p. 309-312. *Doc. 385 issued Aug. 8, 1898.* F12-110

Rathbun, Richard: [Oyster fisheries of Apalachicola Bay.] Report, 1896 (1898), p. 105-109.

Ruge, John G.: The oysters and oyster beds of Florida. Bulletin, 1897 (1898), vol. XVII, p. 289-296. *Doc. 383 issued Aug. 8, 1898.* F12-110

Smith, Hugh M.: [Oyster fisheries of Biscayne Bay.] Report, 1895 (1896), p. 178-179.

Swift, Franklin: Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George Sound, Florida. Report, 1896 (1898), p. 187-221. *Doc. 343 issued 1897.* F11-178

U. S. Bureau of Fisheries: [Oyster industry.] Report, 1896 (1898), p. 278-281.

——— [Notes on the oyster fisheries of Florida.] Report, 1899 (1900), p. 227.

Wilcox, W. A.: [Oyster industry of Indian River.] Report, 1896 (1898), p. 256-257.

LOUISIANA.

Moore, Henry Frank: Report on the oyster beds of Louisiana. Report, 1898 (1899), p. 45-100, pl. 3. *Doc. 402 issued Mar. 22, 1899.* F11-114

Moore, Henry Frank, and T. E. B. Pope: Oyster-culture experiments and investigations in Louisiana. Report and special papers, 1908 (1910), 52 p., VIII pl. *Doc. 731 issued May 14, 1910.* 10-35661

Smith, H. M.: [Oyster investigations in Louisiana.] Report, 1898 (1899), p. CXXIII-CXXV.

U. S. Bureau of Fisheries: [Oyster fisheries of Louisiana.] Report, 1899 (1900), p. 145-147.

U. S. Commissioner of Fisheries: [Louisiana oyster work.] Report, 1908 (1910), p. 9.

Zacharie, F. C.: The Louisiana oyster industry. Bulletin, 1897 (1898), vol. XVII, p. 297-304. *Doc. 384 issued Aug. 8, 1898.* F12-110

MARYLAND.

Ryder, John Adam: Journal of operations on the grounds of the Eastern Shore oyster company, Chincoteague Bay, near Stockton, Md., during the summer of 1883. Bulletin, 1884 (1884), vol. IV, p. 43-47. F18-210

Stevenson, C. H.: The oyster industry of Maryland. (Chronological list of publications relative to the oyster industry of Maryland: p. 296-297.) Bulletin, 1892 (1894), vol. XII, p. 203-297, pl. LVI-LXXI. *Doc. 227 issued Feb. 28, 1894.* F12-165

MASSACHUSETTS.

Wilcox. W. A.: [Oyster industry of Taunton River.] Report, 1894 (1896), p. 136-137.

MISSISSIPPI.

Moore, Henry Frank: Condition and extent of the natural oyster beds and barren bottoms of Mississippi east of Biloxi. Report and special papers, 1911 (1913), 41 p., VI pl., fold. map. *Doc. 774 issued May 16, 1913.* F13-72

U. S. Bureau of Fisheries: [Survey of the natural oyster beds of Mississippi.] Report, 1911 (1913), p. 19.

NEW JERSEY.

Hall, Ansley: Notes on the oyster industry of New Jersey. Report, 1892 (1894), p. 463-528 incl. tables. *Doc. 291 issued Dec. 19, 1894.* F14-44

NEW YORK.

Blackford, Eugene C.: Report of the work in an oyster investigation with the steamer *Lookout*. Bulletin, 1885 (1885), vol. V, p. 52-57. F18-378

——— Report on an oyster investigation in New York with the steamer *Lookout*. Report, 1885 (1887), p. 157-163. F17-143

Rathbun, Richard: [Oyster investigation on Long Island Sound.] Report, 1889-1891 (1893), p. 110-115.

U. S. Commissioner of Fisheries: [Investigation of oyster beds in New York waters.] Report, 1885 (1887), p. CI.

NORTH CAROLINA.

Evermann, Barton Warren: [Report on investigations in oyster planting and culture.] Report, 1904 (1905), p. 83-84.

Grave, Caswell: Investigations for the promotion of the oyster industry of North Carolina. (*Contents.*—Investigations for the promotion of the oyster industry of North Carolina, by C. Grave. Anatomy, embryology, and growth of the oyster, by H. F. Moore. Observations and experiments on the growth of the oysters, by O. C. Glaser.) Report, 1903 (1905), p. 247-341, XI pl., fold. map. *Doc. 556 issued Feb. 2, 1905.* F11-12

Smith, Hugh McCormick: [Survey of the oyster beds of North Carolina.] Report, 1900 (1901), p. 119.

RHODE ISLAND.

U. S. Bureau of Fisheries: [Oyster fisheries of Rhode Island in 1902.] Report, 1904 (1905), p. 314.

SOUTH CAROLINA.

Battle, John D.: An investigation of the coast waters of South Carolina with reference to oyster-culture. Bulletin, 1890 (1892), vol. X, p. 303-330, pl. LIV-LX. *Doc. 199 issued Nov. 2, 1892.* F12-118

Dean, Bashford: The physical and biological characteristics of the natural oyster grounds of South Carolina. Bulletin, 1890 (1892), vol. X, p. 335-361. *Doc. 202 issued Dec. 19, 1892.* F12-121

Rathbun, Richard: [Oyster resources of South Carolina.] Report, 1889-1891 (1893), p. 120-122.

TEXAS.

Moore, Henry Frank: Survey of oyster bottoms in Matagorda Bay, Texas. Report and special papers, 1905 (1907), 86 p., pl., chart. *Doc. 610 issued Mar. 6, 1907.* 7-35165

Moore, Henry Frank, and Ernest Danglade: Condition and extent of the natural oyster beds and barren bottoms of Lavaca Bay, Texas. Appendix II, Report, 1914 (1915), 45 p., V pl., fold. chart. *Doc. 809 issued Feb. 13, 1915.* F15-15

Stevenson, C. H.: [Oyster industry of Texas.] Report, 1889-1891 (1893), p. 386-390.

VIRGINIA.

Edmonds, Richard H.: Review of the oyster industry of Virginia. *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. XI, p. 464-473.

Moore, Henry Frank: Condition and extent of the oyster beds of the James River, Virginia. Report and special papers, 1909 (1911), 83 p., 2 fold. charts. *Doc. 729 issued Jan. 20, 1910.* 10-35064

Rathbun, Richard: [Delineation of public oyster grounds by Virginia.] Report, 1892 (1894), p. CV–CVI.

Smith, Hugh McCormick: [Oyster fisheries of Chesapeake Bay.] Report, 1889–1891 (1893), p. 184–188.

U. S. Bureau of Fisheries: [Oyster fisheries of Virginia.] Report, 1888–89 (1892), p. 349–351.

WASHINGTON.

Collins, Joseph W.: [Oyster industry of Shoalwater Bay.] Report, 1888–89 (1892), p. 238–239.

——— [Oyster fishery of Puget Sound.] Report, 1888–89 (1891), p. 267–268.

Townsend, Charles Haskins: Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. Report, 1889–1891 (1893), p. 343–372. *Doc. 217 issued Nov. 13, 1893.* F16–84

——— The transplanting of eastern oysters to Willapa Bay, Washington, with notes of the native oyster industry. Report, 1895 (1896), p. 193–202. *Doc. 334 issued Jan. 6, 1897.* F11–197

Wilcox, William: [Oyster industry of Willapa Bay.] Report, 1893 (1895), p. 285–286.

——— [Notes on the oyster fisheries of Washington in 1895.] Report, 1896 (1898), p. 602.

ATLANTIC COAST.

McDonald, Marshall: [Work in the interest of the oyster industry of the Atlantic coast.] Report, 1889–1891 (1893), p. 4–5.

MIDDLE ATLANTIC.

Smith, Hugh McCormick: [Oyster fisheries of the Middle Atlantic States.] Bulletin, 1894 (1895), vol. XIV, p. 453–455.

U. S. Bureau of Fisheries: Statistics of the fisheries of the Middle Atlantic States for 1904. (Oysters: p. 27, 50, 61, 84, 117.) Report and special papers, 1905 (1907).

NEW ENGLAND.

Smith, Hugh McCormick: [Oyster industry of New England.] Report, 1894 (1896), p. 133–137.

U. S. Bureau of Fisheries: Statistics of the fisheries of the New England States for 1905. (Oysters: p. 82 and 91.) Report and special papers, 1906 (1908).

——— [Oyster industry of New England States.] Report, 1911 (1913), p. 28–33.

PACIFIC COAST.

Rathbun, Richard: [Report upon the inquiry respecting oyster fisheries of the Pacific coast.] Report, 1893 (1895), p. 29–30.

Townsend, Charles Haskins: Report of observations respecting the oyster resources and oyster fishery of the Pacific coast of the United States. Report, 1889–1891 (1893), p. 343–372. *Doc. 217 issued Nov. 13, 1894.* F16–84

Wilcox, William A.: The commercial fisheries of the Pacific Coast States in 1904. (Oysters: p. 16–18.) Report and special papers, 1905 (1907), 74 p. *Doc. 612 issued Feb. 25, 1907.* 7–35100

CHESAPEAKE BAY.

Rathbun, Richard: [Oyster resources of Maryland and Virginia.] Report, 1889–1891 (1893), p. 122–124.

——— [Oyster investigations in Chesapeake Bay.] Report, 1892 (1894), p. CIII–CVI.

——— [Oyster investigations, Chesapeake Bay.] Report, 1893 (1895), p. 22–23.

Winslow, Francis: Memorandum of the present condition and future needs of the oyster industry. Bulletin, 1884 (1884), vol. IV, p. 233–234. F13–101

EUROPE.

FRANCE.

Coste, Jean Jacques Marie Cyprien Victor: Report on the oyster and mussel industries of France and Italy. Report, 1880 (1883), p. 825–883, XIII pl. F16–277

Dean, Bashford: [European methods of oyster culture.] *Quoted by* Rathbun. Report, 1893 (1895), p. 30–32.

ITALY.

Coste, Jean Jacques Marie Cyprien Victor: Report on the oyster and mussel industries of France and Italy. Report, 1880 (1883), p. 825–883, XIII pl. F16–277

NORWAY.

Kiaer, A. N.: [Norwegian oyster fisheries for 1885.] Report, 1886 (1889), p. 1058.

[Oyster fisheries of Schleswig-Holstein.] Report, 1880 (1883), p. 689–692, illus.

Ström, Boye: [Oyster fisheries of Norway from 1879 to 1883.] Report, 1885 (1887), p. 317.

Yhlen, Gerhard von: [Oyster fisheries of the Län of Göteborg and Bohus in the year 1877.] Report, 1877 (1879), p. 749.

METHODS.

Möbius, Karl August: [Dredge nets.] Report, 1880 (1883), p. 689, illus.

Smith, Hugh McCormick: Notes on an improved form of oyster tongs. Bulletin, 1889 (1891), vol. XI, p. 161–163. *Doc. 158 issued June 16, 1891.* F12–146

PREPARATION AND VALUE AS FOOD.

Atwater, Wilbur Olin: Report of progress of an investigation of the chemical composition and economic values of fish and invertebrates used as food. Undertaken for the United States Fish commission. Report, 1880 (1883), p. 231–285 incl. tables. F16–273

——— The chemical composition and nutritive value of food-fishes and aquatic invertebrates. Report, 1888–89 (1892), p. 679–868. *Doc. 185 issued June 2, 1892.* Agr. 3–567

Churchill, E. P.: [Canning oysters.] Appendix VIII, Report, 1919 (1921), p. 46–48.

Möbius, Karl August: [Chemical constituents and the flavor of the oyster.] Report, 1880 (1883), p. 732–738.

Moore, Henry Frank: Oysters: the food that has not "gone up." A little of their history and how to cook them. 16 p. *Economic Circular 18 issued Aug. 26, 1915.* F15–88

Rowe, Henry C.: The wholesomeness of oysters as food. Bulletin, 1908 (1910), vol. XXVIII, p. 259–267. *Doc. 656 issued 1910.* 10–35134

Ruge, John G.: [Oysters, oldest of food.] Bulletin, 1897 (1898), vol. XVII, p. 289–290.

——— [Earliest records of canning.] Bulletin, 1897 (1898), vol. XVII, p. 289–296.

Rumpff, Carl: The oyster as a popular article of food in North America. Bulletin, 1884 (1884), vol. IV, p. 356–358. F18–333

Ryder, John Adam: [Analysis of the Portuguese and common oyster.] Bulletin, 1882 (1883), vol. II, p. 338.

U. S. Bureau of Fisheries: [Nature of "fat" oysters.] Report, 1918 (1920), p. 26.

Variation in nutritive value of oysters.] Bulletin, 1886 (1887), vol. VI, p. 456.

LAWS AND LEGISLATION.

Broca, P. de: [Laws concerning oyster plantations in the states.] Report, 1873–74 and 1874–75 (1876), p. 299–302.

California Laws, Statutes, etc.: [An act to encourage the planting and cultivation of oysters.] *Quoted by* Townsend. Report, 1889-1891, (1893), p. 365.

Collins, Joseph William: [Oyster legislation of Connecticut.] Bulletin, 1889 (1891), vol. IX, p. 491–497.

Florida Laws, Statutes, etc.: [Extracts from the Florida State law in regard to oysters and the oyster fishery.] Report, 1896 (1898), p. 220–221.

Hall, Ansley: [Acts relative to the oyster industry of New Jersey.] Report, 1892 (1894), p. 498–505.

Massachusetts Laws and Statutes: [Bill authorizing inquiries respecting the destruction of oysters by starfish, etc.] Bulletin, 1886 (1887), vol. VI, p. 407

Moore, Henry Frank: [Oyster legislation and its enforcement.] Bulletin, 1897 (1898), vol. XVII, p. 279–284.

Moore, Henry Frank, and T. E. B. Pope: Oyster culture experiments and investigations in Louisiana. (Legislation in 1902: p. 3–5.) Report and special papers, 1908 (1910). *Doc. 731 issued May 14, 1910.* 10–35661

Oemler, A.: The past, present, and future of the oyster industry of Georgia. Bulletin, 1893 (1894), vol. XIII, p. 263–272. *Doc. 264 issued June, 1894.* F12–183

Ruge, John G.: [Means of protecting the natural and artificial beds.] Bulletin, 1897 (1898), vol. XVII, p. 295–296.

Stevenson, Charles H.: [Oyster laws operative in Texas.] Report, 1889–1891 (1893), p. 391–392.

U. S. Commissioner of Fisheries: [Advance in oyster legislation.] Report, 1905 (1907), p. 19.

Washington Laws, Statutes, etc.: [The oyster laws of Washington.] *Quoted by* Townsend. Report, 1889–1891 (1893), p. 371.

Zacharie, F. C.: [Protecting the Louisiana oyster.] Bulletin, 1897 (1898), vol. XVII, p. 297–304.

Part 6.—MOLLUSCA—Continued.

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GENERAL.

Collins, J. W.: A large squid. Bulletin, 1884 (1884), vol. IV, p. 15. F18-206

Sigerfoos, Charles Peter: Natural history, organization, and late development of the Teredinidæ, or shipworms. Bulletin, 1907 (1908), vol. XXVII, p. 191-231, pls. VII-XXI. *Doc. 639 issued Dec. 18, 1908.* 8-35783

——— Some notes on American shipworms. Bulletin, 1897 (1898), vol. XVII, p. 189-191. *Doc. 369 issued 1898.* F12-110

Wright, H.: [American clams in England.] Bulletin, 1886 (1887), vol. VI, p. 131.

HABITS.

Coker, R. E., A. F. Shira, H. W. Clark, and A. D. Howard: [Habits of fresh-water mussels, p. 81]. Bulletin, 1919-20 (192-), vol XXXVII.

Sigerfoos, Charles Peter: Natural history, organization, and late development of the Teredinidæ, or shipworms. Bulletin, 1907 (1908), vol. XXVII, p. 191-231, pls. VII-XXI. *Doc. 639 issued Dec. 18, 1908.* 8-35783

Simpson, Charles Torrey: The pearly fresh-water mussels of the United States; their habits, enemies, and diseases, with suggestions for their protection. Bulletin, 1898 (1899), vol. XVIII, p. 279-288, illus. *Doc. 413 issued Nov. 1, 1899.* F12-99

PHYSIOLOGY.

Grave, Benjamin Harrison: Anatomy and physiology of the wing-shell *Atrina rigida.* (Bibliography: p. 437-438.) Bulletin, 1909 (1911), vol. XXIX, p. 409-439, illus., pl. XXVIII-L. *Doc. 744 issued May 4, 1911.* F11-156

NUTRITION.

FOOD.

Coker, R. E., A. F. Shira, H. W. Clark, and A. D. Howard: [Food of mussels, p. 87.] Bulletin, 1919–20 (192–), vol. XXXVII.

Field, Irving A.: [Food of mussels.] Bulletin, 1909 (1911), vol. XXIX, p. 92–95.

Lotsey, Johannes Paulus: Food of the oyster, clam, and ribbed mussel. Report, 1893 (1895), p. 375–386. *Doc. 313 issued 1896.* 6–44419

GROWTH.

Coker, R. E., A. F. Shira, H. W. Clark, and A. D. Howard: [Growth and formation of mussel shells, p. 125.] Bulletin, 1919–20 (192–), vol. XXXVII.

Isley, Frederick B.: Experimental study of the growth and migration of fresh-water mussels. Appendix III, Report, 1913 (1914), 24 p., illus., III pl. *Doc. 792 issued July 23, 1914.* F14–60

Kellogg, James Lawrence: [Conditions governing existence and growth of the soft clam (*Mya arenaria*).] Report, 1903 (1905), p. 195–224, illus., pls.

Ryder, John Adam: On the rate of growth of the common clam, and on a mode of obtaining the young of the giant clams of the Pacific coast for the purpose of transplanting. Bulletin, 1885 (1885), vol. V, p. 174–177. F18–397

ENVIRONMENTAL FACTORS.

Mitchell, Philip Henry: The oxygen requirements of shellfish. Bulletin, 1912 (1913), vol. XXXII, p. 207–222. *Doc. 787 issued Feb. 18, 1914.* F14–7

PATHOLOGY AND PATHOLOGICAL CONDITIONS.

Harding, Charles W.: The utilization of localities in Norfolk and Suffolk suitable for the cultivation of mussels and other shellfish. Bulletin, 1882 (1883), vol. II, p. 83–89. F12–348

Ryder, John Adams: On the green coloration of the gills and palps of the clam (*Mya arenaria*). Bulletin, 1885 (1885), vol. V, p. 181–185. F18–400

Simpson, C. T.: The pearly fresh-water mussels of the United States; their habits, enemies, and diseases, with suggestions for their protection. Bulletin, 1898 (1899), vol. XVIII, p. 279–288, illus. *Doc. 413 issued Nov. 1, 1899.* F12–99

MORTALITY.

Nightingale, Harold W.: Concerning the mortality of the soft clams at Essex, Mass. 4 p., illus. *Economic Circular 16 issued Apr. 8, 1915.* F15–43

PARASITES.

Coker, R. E., A. F. Shira, H. W. Clark, and A. D. Howard: [Parasites and enemies of mussels, p. 121.] Bulletin, 1919–20 (192–), vol. XXXVII.

Smith, H. M.: [Parasites of the scallop.] Bulletin, 1889 (1891), vol. IX, p. 318.

EMBRYOLOGY.

Kellogg, James Lawrence: Observations on the life history of the common clam, *Mya arenaria.* Bulletin, 1899 (1901), vol. XIX, p. 193–202, illus. *Doc. 440 issued Aug. 29, 1900.* F14–132

——— A contribution to our knowledge of the morphology of lamellibranchiate mollusks. (List of papers cited: p. 429.) Bulletin, 1890 (1892), vol. X, p. 389–436, pl. LXXIX–XCIV. *Doc. 204 issued Dec. 19, 1892.* F12–123

Koons, Benjamin Franklin: Planting Irish shells—*Helix aspersa* Müller—at Woods Hole, Mass. Bulletin, 1884 (1884), vol. IV, p. 87. F18–234

Lefevre, George, and Winterton Conway Curtis: Experiments in the artificial propagation of fresh-water mussels. Bulletin, 1908 (1910), vol. XXVIII, p. 615–626. *Doc. 671 issued 1910.* 10–35435

——— Studies on the reproduction and artificial propagation of fresh-water mussels. (Bibliography: p. 195–197.) Bulletin, 1910 (1912), vol. XXX, p. 105–201, illus., pl. VI–XVII. *Doc. 756 issued May 10, 1912.* F12–106

Ryder, J. A.: [Discovery of the byssus in *Mya arenaria.*] Report, 1888–89 (1892), p. CII.

——— [Development of the squid.] Report, 1888 (1891), p. 516.

ANATOMY.

Coker, R. E., A. F. Shira, H. W. Clark, and A. D. Howard: [Structure of mussels, p. 167.] Bulletin, 1919–20 (192–), vol. XXXVII.

Grave, Benjamin Harrison: Anatomy and physiology of the wing-shell *Atrina rigida.* (Bibliography: p. 437–439.) Bulletin, 1909 (1911), vol. XXIX, p. 409–439, illus., pl. XLVIII–L. *Doc. 744 issued May 4, 1911.* F11–156

Kellogg, James Lawrence: A contribution to our knowledge of the morphology of lamellibranchiate mollusks. (List of papers cited: p. 429.) Bulletin, 1890 (1892), vol. X, p. 389–436. *Doc. 204 issued Dec. 19, 1892.* F12–123

CULTURE.

Hessell, Rudolph: Artificial culture of medicinal leeches and of species of Helix. Bulletin, 1881 (1882), vol. I, p. 264–265. F18–51

Mitsukuri, Kakichi: [Culture of haigai, agemaki, jimegi, tairagai, bakagai, and namako in Japan.] Bulletin, 1904 (1905), vol. XXIV, p. 284–288.

Yaeger, B. S.: [Shellfish wanted in Utah.] Bulletin, 1885 (1885), vol. V, p. 468.

CLAMS.

Detwiler, John Y.: [Propagation of the soft clam.] Bulletin, 1897 (1898), vol. XVII, p. 311.

Hall, A.: [Inception of clam culture at Essex, Mass.] Report, 1894 (1896), p. 139–140.

Kellogg, James Lawrence: Observations on the life history of the common clam, *Mya arenaria.* Bulletin, 1899 (1901), vol. XIX, p. 193–202, illus. *Doc. 440 issued Aug. 29, 1900.* F14–132

——— The clam problem and clam culture. Bulletin, 1899 (1901), vol. XIX, p. 39–44, pl. 13 (fold.). *Doc. 432 issued Aug. 29, 1900.* F12–44

Ryder, John Adam: On the rate of growth of the common clam, and on a mode of obtaining the young of the giant clams of the Pacific coast for the purpose of transplanting. Bulletin, 1885 (1885), vol. V, p. 174–176. F18–397

Stearns, Robert Edward Carter: Suggestions for transplanting clams from the Pacific Ocean to the Atlantic. Bulletin, 1882 (1883), vol. II, p. 20–21. F18–60

——— [Description of the Stearns tank for the transportation of clams from the Pacific Ocean to the Atlantic.] Bulletin, 1883 (1883), vol. III, p. 353–362.

U. S. Bureau of Fisheries: [Notes on clam culture.] Report, 1897 (1898), p. 339–340; also *in* Manual of fish-culture, rev. ed., 1900. p. 339–340.

MUSSELS.

Coker, R. E., A. F. Shira, H. W. Clark, and A. D. Howard: The natural history and propagation of fresh-water mussels. (Bibliography, p. 176). Bulletin, 1919–20 (192), vol. XXXVII, p. 75–181, illus., pl. V–XXI. *Doc. 893 issued 1921.*

Harding, Charles W.: The utilization of localities in Norfolk and Suffolk suitable for the cultivation of mussels and other shellfish. Bulletin, 1882 (1883), vol. II, p. 83–89. F12–348

Howard, A. D.: Experiments in propagation of fresh-water mussels of the Quadrula group. Appendix IV, Report, 1913 (1914), 52 p. *Doc. 801 issued Oct. 17, 1914.* F14–105

Lefevre, George, and Winterton Conway Curtis: Experiments in the artificial propagation of fresh-water mussels. Bulletin, 1908 (1910), vol. XXVIII, p. 615–626. *Doc. 671 issued 1910.* 10–35435

——— Studies on the reproduction and artificial propagation of fresh-water mussels. (Bibliography: p. 195–197.) Bulletin, 1910 (1912), vol. XXX, p. 105–201, illus., pl. VI–XVII. *Doc. 756 issued May 10, 1912.* F12–106

Nansouty, Max de: [Mussel (*Mytilus edulis*) culture in France.] Bulletin, 1886 (1887), vol. VI, p. 131–132.

Surber, Thaddeus: Notes on the natural hosts of fresh-water mussels. Bulletin, 1912 (1913), vol. XXXII, p. 101–116, pl. XXIX–XXXI. *Doc. 778 issued June 28, 1913.* F13–218

——— Identification of the glochidia of fresh-water mussels. Report and special papers, 1912 (1914), 10 p., III pl. *Doc. 771 issued 1914.* F13–35

——— Identification of the glochidia of fresh-water mussels. Appendix V, Report, 1914 (1915), 9 p., pl. *Doc. 813 issued Mar. 11, 1915.* F15–31

U. S. Bureau of Fisheries: [Pearl-mussel investigations.] Report, 1908 (1910), p. 8–9; 1909 (1911); p. 13–14; 1910 (1911), p. 16–17; 1911 (1913), p. 20; 1912 (1914), p. 56–57; 1913 (1914), p. 28.

U. S. Bureau of Fisheries: [Propagation of fresh-water mussels.] Report, 1912 (1914), p. 56; 1915 (1917), p. 32–33; 1916 (1917), p. 33; 1917 (1919), p. 78–79; 1918 (1920), p. 17–18.

SNAILS.

Hessel, Rudolph: Culture of edible snails. Bulletin, 1884 (1884), vol. IV, p. 166. F18–262

FISHERIES.

UNITED STATES.

Winslow, Francis: Catalogue of the economic Mollusca and apparatus and appliances used in their capture and preparation for market, exhibited by the U. S. National museum. [Great International fisheries exhibition, London, 1883, U. S. 1883.] 86 p. *Doc. 57 issued June 14, 1883.* F12–293

ABALONE.

Ingersoll, Ernest: The abalone fishery. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XX, p. 622–626.

Wilcox, William A.: [Abalone fishery in California.] Report, 1901 (1902), p. 570–572.

——— The commercial fisheries of the Pacific Coast States for 1904. (Abalone: p. 18–19.) Report and special papers, 1905 (1907), 74 p. *Doc. 612 issued Feb. 25, 1907.* 7–35100

CLAMS.

Ingersoll, Ernest: The clam fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XX, p. 581–615.

Kellogg, J. L.: The clam problem and clam culture. Bulletin, 1899 (1901), vol. XIX, p. 39–44, pl. 13. *Doc. 432 issued Aug. 29, 1900.* F12–44

Moore, C. R.: Introduction of clams into Delaware Bay. Bulletin, 1885 (1885), vol. V, p. 426. F18–493

Schroeder, William Charles: Clam resources of the Ten Thousand Islands, Fla. 5 p. *Economic Circular 46 issued Feb. 20, 1920.* F20–107

U. S. Bureau of Fisheries: Report of the special commission for the investigation of the lobster and the soft-shell clam. (*Contents.*—I. General account of the lobster and clam investigations, by H. M. Smith. II. Experiments in lobster rearing, by G. H. Sherwood. III. The causes of death in artificially reared lobster fry, by F. P. Gorham. IV. Conditions governing the existence and growth of the soft clam, *Mya arenaria*, by J. L. Kellogg.) Report, 1903 (1905), p. 139–224, pl. I–X. *Doc. 554 issued Jan. 21, 1905.* F11–10

MUSSELS.

Coker, Robert Ervin: The protection of fresh-water mussels. Report and special papers, 1912 (1914), 23 p., II pl. *Doc. 793 issued Feb. 7, 1914.* F14–12

——— Fresh-water mussels and mussel industries of the United States. Bulletin, 1917–1918 (1921), vol. XXXVI, p. 13–89, XLVI pl., fold. chart. *Doc. 865 issued Oct. 25, 1919.* F19–40

Coker, R. E., and J. B. Southall: Mussel resources in tributaries of the upper Missouri River. (With description of shell found in the James River at Huron, S. Dak., July 27, 1913.) Appendix IV, Report, 1914 (1915), 17 p. incl. map, pl. *Doc. 812 issued Mar. 20, 1915.* F15–18

Danglade, Ernest: Condition of the mussel fishery of the Illinois River in 1912. 4 p. *Economic Circular 2 issued Sept. 20, 1912.* F12–281

Danglade, Ernest, and John A. Eldridge: The mussel resources of the Illinois River, by Ernest Danglade. The mussel fishery of the Fox River, by John A. Eldridge. Appendixes VI and VII, Report, 1913 (1914), 48 p., 8 p., illus., VI pl. *Doc. 804 issued Sept. 30, 1914.* F14–103

Ingersoll, Ernest: Mollusks in general. *In* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. IV, p. 683–710.

——— [Mussel fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XX, p. 615–622.

Kunz, George F.: [Extermination of the mollusks.] Bulletin, 1897 (1898), vol. XVII, p. 328–330.

Shira, Austin F.: The mussel fisheries of Caddo Lake and Cypress and Sulpher rivers of Texas and Louisiana. 10 p. *Economic Circular 6 issued Dec. 10, 1913.* F13–217

Smith, Hugh McCormick: [The mussel fishery of the Mississippi River.] Bulletin, 1898 (1899), vol. XVIII, p. 292–303, illus.

Smith, H. M.: Fresh-water mussels. A valuable national resource without sufficient protection. 5 p. *Economic Circular 43 issued Feb. 12, 1919.* F19-2

U. S. Bureau of Fisheries: [Statistics of fresh-water mussel fishery of the Mississippi River and its western tributaries from Kansas northward in 1914.] Report, 1916 (1917), p. 50-57.

——— [Fresh-water mussel fishery.] Report, 1914 (1915), p. 25-34; 1915 (1917), p. 63-70; 1916 (1917), p. 50-57.

PEARL.

Alexander, Alvin Burton: [Pearl fishery.] Report, 1901 (1902), p. 764.

Bouchon-Brandely, Germain: The pearl fisheries of Tahiti. Bulletin, 1885 (1885), vol. V, p. 292-294. F18-445

——— Pearls and mother-of-pearl at Tahiti and Tuamotu Archipelago. Report, 1885 (1887), p. 353-377. F17-145

Griffin, G. W.: The pearl fisheries of Australia. Bulletin, 1886 (1887), vol. VI, p. 433-435. F18-624

Kunz, George Frederick: On pearls, and the utilization and application of the shells in which they are found in ornamental arts, as shown at the world's Columbian exposition. Bulletin, 1893 (1894), vol. XIII, p. 439-457, pl. 18-40 (part. col.). *Doc. 278 issued 1894.* F12-183

——— A brief history of the gathering of fresh-water pearls in the United States. Bulletin, 1897 (1898), vol. XVII, p. 321-330. *Doc. 389 issued 1898.* F12-110

——— The fresh-water pearls and pearl fisheries of the United States. Bulletin, 1897 (1898), vol. XVII, p. 375-426, illus., XXII pl. (incl. col. front.). *Doc. 397 issued Oct. 11, 1898.* F15-12

Solomon, John I.: A process for preserving the pearl-oyster fisheries and for increasing the value of the yield of pearls. Bulletin, 1908 (1910), vol. XXVIII, illus., p. 305-313. 10-35154

——— [Utilizing the X-ray for preserving the pearl-oyster fisheries.] Bulletin, 1908 (1910), vol. XXVIII, p. 307-313.

Townsend, Charles Haskins: [Pearl fishery of the Tuamotu Archipelago.] Report, 1900 (1901), p. 181-182.

——— Report upon the pearl fishery of the Gulf of California. Bulletin, 1889 (1891), vol. IX, p. 91-94, pl. 28-30. *Doc. 152 issued July 11, 1891.* F12-140

Weber, Max William Carl: Pearls and pearl fisheries. Bulletin, 1886 (1887), vol. VI, p. 321-328. F18-602

SCALLOP.

Schmidt, Waldo L.; E. C. Johnston; E. P. Rankin; and Edward Driscoll: Survey of the fishing grounds on the coast of Washington and Oregon in 1914. (Scallops: p. 26-27.) Appendix VII, Report, 1914 (1915), 30 p. *Doc. 817 issued June 8, 1915.* F15-86

Slade, Elisha: [Abundance of scallops.] Bulletin, 1885 (1885), vol. V, p. 89.

Smith, H. M.: The giant scallop fishery of Maine. Bulletin, 1889 (1891), vol. IX, p. 313-335, pl. CXII-CXVI (partly fold.). *Doc. 163 issued July 24, 1891.* F12-151

Welsh, W. W.: Opportunity for a new sea scallop fishery off the Middle Atlantic coast. 5 p., illus. *Economic Circular 7 issued Jan. 28, 1914.* F14-3

SQUID.

Wilcox, William A.: The commercial fisheries of the Pacific Coast States. (Squid: p. 19-20.) Report and special papers, 1905 (1907).

EUROPE.

Coste, Jean Jacques Marie Cyprien Victor: Report on the oyster and mussel industries of France and Italy. Report, 1880 (1883), p. 825-883, CIII pl. F16-277

LEGISLATION FOR MUSSELS.

Coker, Robert Ervin: The protection of fresh-water mussels. Report and special papers, 1912 (1914), 23 p., pl. *Doc. 793 issued Feb. 7, 1914.* F14-12

Kunz, George F.: [Nation and State protection for mussels.] Bulletin, 1897 (1898), vol. XVII, p. 330.

Simpson, C. T.: The pearly fresh-water mussels of the United States; their habits, enemies, and diseases, with suggestions for their protection. Bulletin, 1898 (1899), vol. XVIII, p. 279-288, illus. *Doc. 413 issued Nov. 1, 1899.* F12-99

PRODUCTS.

BUTTONS.

Coker, Robert Ervin: Fresh-water mussels and mussel industries of the United States. Bulletin, 1917–18 (1921), vol. XXXVI, p. 13–89, illus., XLVI pl. (1 col.), fold. chart. *Doc. 865 issued Oct. 25, 1919.* F19–40

Kunz, George F.: [Utilization of unic shells for buttons.] Bulletin, 1897 (1898), vol. XVII. p. 327, 425–426.

Smith, Hugh McCormick: The mussel fishery and pearl-button industry of the Mississippi River. Bulletin, 1898 (1899), vol. XVIII, p. 289–314, illus., pl. 65–85. *Doc. 414 issued Oct. 26, 1899.* F12–100

U. S. Bureau of Fisheries: [Statistics of the pearl-button industry of the United States.] Report, 1914 (1915), p. 31–35.

SHELLFISH AS FOOD.

MISCELLANEOUS.

Stearns, Robert Edward Carter: Edible shellfish found near Cuba. Bulletin, 1885 (1885), vol. V, p. 311–312. F18–458

CLAMS.

Hemphill, Henry: On the habits and distribution of the geoduck, a clam of the Pacific (*Glycimeris generosa* Gld.), with suggestions as to its introduction into the Atlantic coast of the United States. Bulletin, 1881 (1882), vol. I, p. 200–201. F18–35

Moser, Jefferson F.: [Packing clams at Klawak.] Bulletin, 1898 (1899), vol. XVIII, p. 111–112.

Ryder, John Adam: A valuable edible mollusk of the west coast. Bulletin, 1881 (1882), vol. I, p. 21. F18–9

Stearns, Robert Edward Carter: The edible clams of the Pacific coast and a proposed method of transplanting them to the Atlantic coast (*Glycimeris generosa, Saxidomus nuttallii, Schizothoerus nuttallii.*) Bulletin, 1883 (1883), vol. III, p. 353–362, illus. F12–420

Stevenson, Charles H.: [Extracts of clams and oysters.] Bulletin, 1898 (1899), vol. XVIII, p. 553–556.

MUSSELS.

Field, Irving A.: Sea mussels and dogfish as food. [With discussion by Oscar Nordqvist, Theodore Gill, Charles E. Fryer, T. E. Libby, C. G. Atkins, Edward E. Prince, George W. Field, Walter E. Hathaway, and E. C. Whitman.] Bulletin, 1907 (1908), vol. XXVIII, p. 241–257. *Doc. 655 issued 1910.* 10–35138

——— The food value of sea mussels. (Literature: p. 126–128.) Bulletin, 1909 (1911), vol. XXIX, p. 85–128, illus., pl. XVIII–XXV. *Doc. 742 issued Feb. 24 1911.* F11–7

U. S. Bureau of Fisheries: Sea mussels: what they are and how to cook them. With eighteen recipes (furnished by Mr. Charles Doucot). 5 p., illus. *Economic Circular 12 issued Mar. 24, 1914.* F14–9

SCALLOPS.

Smith, Hugh McCormick: [Food value of the scallop.] Bulletin, 1889 (1891), vol. IX, p. 330–331.

SQUID.

Collins, Joseph William: Notes on the use of squid for food in the United States. Bulletin, 1887 (1889), vol. VII, p. 127–128. F18–66

——— [Use of squid as food.] Report, 1887 (1891), p. 351.

GEOGRAPHICAL DISTRIBUTION.

UNITED STATES.

GENERAL.

Berry, Samuel Stillman: A review of the cephalopods of western North America. (Bibliography: p. 318–325.) Bulletin, 1910 (1912), vol. XXX, p. 267–336, illus., pl. 32–56. *Doc. 761 issued July 24, 1912.* F12–202

Bush, Katharine Jeanette: List of deep-water Mollusca dredged by the U. S. Fish commission steamer *Fish Hawk* in 1880, 1881 and 1882, with their range of depth. Report, 1883 (1885), p. 701–727. *Doc. 100 issued Aug. 16, 1886.* F11–244

Coker, Robert Ervin: The common and scientific names of fresh-water mussels. 4 p. *Economic Circular 15 issued Apr. 8, 1915.* F15–42

Hemphill, Henry: On the habits and distribution of the geoduck, a clam of the Pacific (*Glycimeris generoasa*, Gld.), with suggestions as to its introduction into the Atlantic coast of the United States. Bulletin, 1881 (1882), vol. I, p. 200–201. F18–35

Ingersoll, Ernest, and John A. Ryder: Natural history of economic mollusks of the United States. (Extracted *from* The fisheries and fishery industries of the United States. 1884. Sec. I, pt. IV, p. 687–758, pl. 253–259.) *Doc. 223 issued Nov. 16, 1893.* F12–29

Nye, Willard: Notes upon octopus, flying-fish, etc., taken during the *Albatross* cruise in January, 1884. Bulletin, 1885 (1885), vol. V, p. 189–190. F18–40

Ryder, John A.: A valuable edible mollusk of the west coast. Bulletin, 1881 (1882) vol. I, p. 21. F18–9

Simpson, Charles Torrey: The pearly fresh-water mussels of the United States; their habits, enemies, and diseases, with suggestions for their protection. Bulletin, 1898 (1899), vol. XVIII, p. 279–288, illus. *Doc. 413 issued Nov. 1, 1899.* F12–99

Smith, Hugh McCormick: [The soft clam of the Atlantic.] Bulletin, 1895 (1896), vol. XV, p. 467–469.

Stearns, Robert Edward Carter: Note on the clams of the Pacific coast. Bulletin, 1885 (1885), vol. V, p. 356. F18–472

Verrill, Addison Emory, and S. I. Smith: Report upon the invertebrate animals of Vineyard Sound and adjacent waters, with an account of the physical features of the region. Report, 1871–72 (1873), p. 295–778, XXXVIII pl. F15–102

——— Report on the cephalopods of the northeastern coast of America. Report, 1879 (1882), p. 211–455, XLVI pl. *Doc. 42 issued Apr. 10, 1882.* 10–30404

——— Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, and of some additions to the fauna of Vineyard Sound. Report, 1882 (1884), 29 p. *Doc. 83 issued Aug. 15, 1884.* F11–267

——— [Mollusca taken by the steamer *Albatross* off the northern coast of the United States.] Report, 1883 (1885), p. 525–529, XLIV pl.

Winslow, Francis: Catalogue of the economic Mollusca and the apparatus and appliances used in their capture and preparation for market, exhibited by the United States National Museum. (Great International fisheries exhitition, London. 1883.) 86 p. *Doc. 57 issued June 14, 1883.* F12–293

ARKANSAS.

Meek, Seth Eugene: A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894. Bulletin, 1895 (1896), vol. XV, p. 341–350. *Doc. 306 issued Apr. 9, 1897.* 6–19634

——— The mussels of the Big Buffalo fork of White River, Arkansas. Report and special papers, 1911 (1913), 20 p. *Doc. 759 issued July 22, 1912.* F12–49

CALIFORNIA.

MacFarland, Frank Mace: Opisthobranchiate Mollusca from Monterey Bay, California, and vicinity. Bulletin, 1905 (1906), vol. XXV, p. 109–151, pl. XVIII–XXXI (part. col.). *Doc. 597 issued May 24, 1906.* F11–68

ILLINOIS.

Wilson, Charles Branch: The mussel fauna of the Kankakee basin. Report and special papers, 1911 (1913), 52 p., pl., fold. map. *Doc. 758 issued Mar. 19, 1912.* F12–48

INDIANA.

Clark, H. W., and C. B. Wilson: The mussel fauna of the Maumee River. Report and special papers, 1911 (1913), 72 p., II pl. *Doc. 757 issued Apr. 22, 1912.* F12–77

Kirsch, Philip H.: [List of fresh-water mollusks collected in the Maumee River basin during the summer of 1893 by A. J. Woolman and Philip H. Kirsch.] Bulletin, 1894 (1895), vol. XIV, p. 332.

MAINE.

Kendall, W. C.: Fishes and fishing in Sunapee Lake. (Mollusks: p. 88.) Report and special papers, 1912 (1914), 96 p. *Doc. 783 issued Jan. 28, 1914.* F14–1

MASSACHUSETTS.

Koons, B. F.: Planting Irish shells—*Helix aspersa*, Müller—at Woods Hole. Bulletin, 1884 (1884), vol. IV, p. 87. F18–234

MINNESOTA.

Wilson, Charles Branch, and Ernest Danglade: Mussels of central and northern Minnesota. 6 p. *Economic Circular 3 issued Oct. 26, 1912.* F12–314

——— The mussel fauna of central and northern Minnesota. Appendix V, Report, 1913 (1914), 26 p., fold. map. *Doc. 803 issued Sept. 15, 1914.* F14–102

MISSOURI.

Utterback, W. I.: Mussel resources in Missouri. 6 p. *Economic Circular 10 issued Feb. 27, 1914.* F14–95

NEW YORK.

Evermann, Barton Warren, and E. L. Goldsborough: Notes on the fishes and mollusks of Lake Chautauqua, New York. Report, 1901 (1902), p. 169–175. *Doc. 483 issued Mar. 28, 1902.* F11–19

OKLAHOMA.

Isely, Frederick B.: Mussel streams of eastern Oklahoma. 4 p. *Economic Circular 9 issued Feb. 17, 1914.* F14–9

TENNESSEE.

Boepple, Johann Frederick, and Robert Ervin Coker: Mussel resources of the Holston and Clinch rivers of eastern Tennessee. Investigations by J. F. Boepple. Notes compiled by R. E. Coker. Report and special papers, 1911 (1913), 13 p. *Doc. 765 issued Sept. 23, 1912.* F12–306

Wilson, C. B., and H. W. Clark: Mussel beds of the Cumberland River in 1911. 4 p. *Economic Circular 1 issued Feb. 13, 1912.* F12–54

——— The mussels of the Cumberland River and its tributaries. Report and special papers, 1912 (1914), 63 p., pl. *Doc. 781 issued Jan. 28, 1914.* F14–2

TEXAS.

Singley, J. A.: [List of Mollusca collected in Texas in 1891.] Bulletin, 1892 (1894), vol. XII, p. 123–125.

RIVERS.

Coker, R. E.: Water-power development in relation to fishes and mussels of the Mississippi. Appendix VIII, Report, 1913 (1914), 28 p. *Doc. 805 issued Nov. 11, 1914.* F14–130

——— Mussel resources of the Tensas River of Louisiana. 7 p. *Economic Circular 14 issued Apr. 9, 1915.* F15–41

Coker, Robert Ervin, and John B. Southall: Mussel resources in tributaries of the upper Missouri River. (With description of shell found in the James River at Huron, S. Dak., July 27, 1913.) Appendix IV, Report, 1914 (1915), 17 p. incl. map., pl. *Doc. 812 issued Mar. 20, 1915.* F15–18

Danglade, Ernest: Condition of the mussel fishery of the Illinois River in 1912. 4 p. *Economic Circular 2 issued Sept. 20, 1912.* F12–281

Danglade, Ernest, and John A. Eldridge: The mussel resources of the Illinois River, by Ernest Danglade. The mussel fishery of the Fox River, by John A. Eldridge. Appendixes VI and VII, Report, 1913 (1914), 48 p., 8 p., illus., VI pl. (incl. front. and fold. map). *Doc. 804 issued Sept. 30, 1914.* F14–103

PORTO RICO.

Dall, William Healey, and Charles Torrey Simpson: The Mollusca of Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. I, p. 351–524, pl. 53–58. *Doc. 458 issued* Nov. *29, 1901.* F12–251

HAWAIIAN ISLANDS.

Berry, Samuel Stillman: The Cephalopoda of the Hawaiian Islands. (Bibliography: p. 352–357.) Bulletin, 1912 (1913), vol. XXXII, p. 255–362, illus., pl. XLV–LV. *Doc. 789 issued June 24, 1914.* F14–59

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Part 7.—CRUSTACEA.

GENERAL.

Churchill, Edward Perry: Life history of the blue crab. Bulletin, 1917–18 (1921), vol. XXXVI, p. 93–128, illus., pl. XLVII–LV (one col.). *Doc. 870 issued Nov. 11, 1919.* F19–42

Coker, Robert Ervin: Notes on a species of barnacle (Dichelaspis) parasitic on the gills of edible crabs. (Literature cited: p. 412.) Bulletin, 1901 (1902), vol. XXI, p. 399–412, illus. *Doc. 503 issued Oct. 23, 1902.* F12–279

Hay, William Perry: The life history of the blue crab (*Callinectes sapidus*). Report, 1904 (1905), p. 395–413, pls. *Doc. 580 issued Sept. 5, 1905.* F10–10

Herrick, Francis Hobart: The habits and development of the lobster and their bearing upon its artificial propagation. Bulletin, 1893 (1894), vol. XIII, p. 75–86. *Doc. 247 issued June 26, 1894.* F12–183

——— The American lobster: A study of its habits and development. (Bibliography: p. 229–237.) Bulletin, 1895 (1896), vol. XV, 252 p., illus., A–J, 54 pl. (partly col.). *Doc. 300 issued Feb. 14, 1896.* F12–249

——— Natural history of the American lobster. (Bibliography: p. 384–408.) Bulletin, 1909 (1911), vol. XIX, p. 149–408, illus., pl. XXVIII–XLVII (partly col.). *Doc. 747 issued July 13, 1911.* F11–278

Rathbun, Richard: The crustaceans, worms, radiates, and sponges. *In* The fisheries and fishery industries of the United States. 1887. Sec. I, pt. V, p. 759–850.

——— The crab, lobster, crayfish, rock lobster, shrimp, and prawn fisheries. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXI, p. 629–658.

Smith, Hugh McCormick: [Spiny lobster (*Panulirus interruptus*).] Bulletin, 1894 (1895), vol. XIV, p. 280–281.

Thompson, Millett T.: A new isopod parasitic on the hermit crab. (Bibliography p. 56.) Bulletin, 1901 (1902), vol. XXI, p. 53–56, pl. 9–10. *Doc. 478 issued Oct. 18, 1901.* F12–268

Wilson, Charles Branch: Copepod parasites of fresh-water fishes and their economic relations to mussels glochidia. Bulletin, 1914 (1916), vol. XXXIV, p. 331–374, pl. LX–LXXIV. *Doc. 824 issued June 28, 1916.* F16–106

——— The economic relations, anatomy, and life history of the genus Lernæa. Bulletin, 1915–16 (1918), vol. XXXV, p. 165–198, illus., pl. VI–XV. *Doc. 854 issued Dec. 22, 1917.* F18–4

HABITS AND BEHAVIOR.

Herrick, Francis H.: The habits and development of the lobster and their bearing upon its artificial propagation. Bulletin, 1893 (1894), vol. XIII, p. 75–86. *Doc. 247 issued June 26, 1894.* F12–183

——— The American lobster: A study of its habits and development. (Bibliography: p. 229–237.) Bulletin, 1895 (1896), vol. XV, 252 p., illus., A–J., 54 pl. (partly col.). *Doc. 300 issued Feb. 14, 1896.* F12–249

——— Natural history of the American lobster. Bulletin, 1909 (1911), vol. XIX, p. 149–408, illus., pl. XXVIII–XLVII (partly col.). *Doc. 747 issued July 13, 1911.* F11–278

Mather, Fred: What we know of the lobster. Bulletin, 1893 (1894), vol. XIII, p. 281–286. *Doc. 265 issued June 9, 1894.* F12–183

Nye, Willard: A reasoning lobster. Bulletin, 1886 (1887), vol. VI, p. 186.

Smith, A. C.: Notes on the lobster—*Homarus americanus*. Bulletin, 1885 (1885), vol. V, p. 121–125. F18–383

PHYSIOLOGY.

Bumpus, Hermon Carey: On the movements of certain lobsters liberated at Woods Hole during the summer of 1898. Bulletin, 1899 (1901), vol. XIX, p. 225–230, fold. map. *Doc. 442 issued Sept. 12, 1900.* F12–82

Churchill, Edward Perry: [Migration of crabs in Chesapeake Bay.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 108–113.

——— [Moulting and autotomy of the blue crab.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 104–108.

Herrick, Francis Hobart: [Moulting and growth of the lobster.] Bulletin, 1895 (1896), vol. XV, p. 75–99.

——— [Regeneration of lost parts.] Bulletin, 1895 (1896), vol. XV, p. 20–27.

——— [Periodical migration and their relation to changes in the environment.] Bulletin, 1895 (1896), vol. XV, p. 20–27.

Mather, Fred: What we know about the lobster. Bulletin, 1893 (1894), vol. XIII, p. 281–286. *Doc. 265 issued June 9, 1894.* F12–183

Parker, George Howard: The reactions of copepods to various stimuli and the bearing of this on daily depth-migrations. (Papers quoted: p. 123.) Bulletin, 1901 (1902), vol. XXI, p. 103–123. *Doc. 497 issued May 23, 1902.* F12–237

Smith, Albert W.: [Composition of the shell and gastroliths of the lobster.] Bulletin, 1895 (1896), vol. XV, p. 227–228.

TEMPERATURE—PHYSIOLOGICAL EFFECT.

Wood, William Maxwell: Transplanting lobsters to the Chesapeake—Experiments upon the temperature they can endure. Bulletin, 1885 (1885), vol. V, p. 31–32. F18–368

NUTRITION.

Herrick, Francis Hobart: [Food of the lobster.] Bulletin, 1895 (1896) vol. XV, p. 29–32.

PATHOLOGY.

DISEASES AND PESTS.

Coker, Robert Ervin: Notes on a species of barnacle (Dichelaspis) parasitic on the gills of the edible crabs. (Literature cited: p. 412.) Bulletin, 1901 (1902), vol. XXI, p. 399–412, illus. *Doc. 503 issued Oct. 23, 1902.* F12–279

Gorham, Frederic Poole: The causes of death in the artificially reared lobster-fry. Report of the special commission for the investigation of the lobster and soft-shell clam. Report, 1903 (1905), p. 175–193.

Raveret-Wattel, C.: Notes on a disease affecting crawfish in Germany. Bulletin, 1884 (1884), vol. IV, p. 299–302. F13–109

Thompson, Millett T.: A new isopod parasite on the hermit crab. (Bibliography: p. 56.) Bulletin, 1901 (1902), vol. XXI, p. 53–56, pl. 9–10. *Doc. 478 issued Oct. 18, 1901.* F12–268

ENEMIES.

Herrick, Francis Hobart: [Enemies of the lobster.] Bulletin, 1895 (1896), vol. XV, p. 120–124.

EMBRYOLOGY.

Churchill, Edward Perry: [Reproduction in the blue crab.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 115–123.

Hay, William Perry: The life history of the blue crab (*Callinectes sapidus*). Report 1904 (1905), p. 395–413. *Document 580 issued Sept. 5, 1904.* F10–10

Herrick, Francis H.: The habits and development of the lobster and their bearing upon its artificial propagation. Bulletin, 1893 (1894), vol. XIII, p. 75–86. *Doc. 247 issued June 26, 1894.* F12–183

——— The American lobster: A study of its habits and development. (Bibliography: p. 229–237.) Bulletin, 1895 (1896), vol. XV, 252 p., illus., A–J, 54 pl. (partly col.). *Doc. 300 issued Feb. 14, 1896.* F12–249

——— [Spawning habits of the lobster.] Bulletin, 1897 (1898), vol. XVII, p. 218–219. The reproductive period in the lobster. Bulletin, 1901 (1902), vol. XXI, p. 161–166, illus. *Doc. 500 issued Oct. 1, 1902.* F12–276

——— Natural history of the American lobster. (Bibliography: p. 384–408.) Bulletin, 1909 (1911), vol. XXIX, p. 149–408, illus., pl. XXVIII–XLVII (partly col.). *Doc. 747 issued July 13, 1911.* F11–278

Mather, Fred: What we know of the lobster. Bulletin, 1893 (1894), vol. XIII, p. 281–286. *Doc. 265 issued June 9, 1894.* F12–183

CULTURE.

CRABS.

Leslie, Charles G.: On the cultivation of soft-shell crabs. Bulletin, 1884 (1884), vol. IV, p. 256. F18–301

CRAWFISH.

Rubelius, H.: Crawfish culture in Europe. Report, 1879 (1882), p. 767–770. F17–21

Wozelka-Iglau, Karl: Contributions toward the improvement of the culture of the salmonoids and crawfish in smaller water-courses. Bulletin, 1895 (1896), vol. XV, p. 369–378. *Doc. 308 issued 1896.* F12–250

LOBSTER.

B.: On the artificial propagation of the lobster. Report, 1873–74 and 1874–75 (1876), p. 267–269. F16–16

Dannevig, Gunder Mathisen: Success in hatching lobster eggs in Norway. Bulletin, 1885 (1885), vol. V, p. 280. F18–438

——— Artificial hatching of salt-water fish and lobsters in Norway. Bulletin, 1885 (1885), vol. V, p. 437–440. F18–501

——— Hatching lobsters in Norway. Bulletin, 1885 (1885), vol. V, p. 446. F18–503

——— Hatching lobsters and cod in Norway. Bulletin, 1886 (1887), vol. VI, p. 13–14. F18–562

Gorham, Frederic Poole: [The causes of death in artificially reared lobster-fry.] Report of the special commission for the investigation of the lobster and soft-shell clam. Report, 1903 (1905), p. 175–193, pls.

Herrick, Francis Hobart: The habits and development of the lobster and their bearing upon its artificial propagation. Bulletin, 1893 (1894), vol. XIII, p. 75–86. *Doc. 247 issued June 26, 1894.* F12–183

Mead, Albert Davis: A method of lobster-culture. (With discussion by Henry T. Root.) Bulletin, 1908 (1910), vol. XXVIII, p. 219–240, illus., pl. VII–XI. *Doc. 654 issued February, 1910.* 10–35151

Perrin, M. L.: Transportation of lobsters to California. Report, 1873–74 and 1874–75 (1876), p. 259–265. F16–15

Rathbun, Richard: Notes on lobster culture. Bulletin, 1886 (1887), vol. VI, p. 17–32. F18–528

——— The transplanting of lobsters to the Pacific coast of the United States. Bulletin, 1888 (1890), vol. VIII, p. 453–472, pl. LXX–LXXI. *Doc. 146 issued Apr. 25, 1891.* F16–82

——— [Development and propagation of the lobster.] Report, 1888 (1891), p. XCVII–CII.

Sherwood, George H.: [Experiments in lobster rearing.] Report, 1903 (1905), p. 149–174 incl. tables, illus., pls.

Smith, Hugh McCormick: [Introduction of the eastern lobster to the Pacific coast.] Bulletin, 1895 (1896), vol. XV, p. 459–464.

——— [Propagation of the American lobster.] Report, 1897 (1898), p. 229–238; also *in* Manual of fish-culture, rev. ed., 1900, p. 229–238.

Wood, W. M.: The transplanting of one hundred lobsters from the eastern part of Long Island to Chesapeake Bay. Bulletin, 1884 (1884), vol. IV, p. 16. F18–208

——— Transplanting lobsters to the Chesapeake—Experiments upon the temperture they can endure. Bulletin, 1885 (1885), vol. V, p. 31–32. F18–368

SHRIMP.

Mather, Fred: Notes on cod, shrimp, etc., at Cold Springs Harbor. Bulletin, 1884 (1884), vol. IV, p. 123. F18–242

FISHERIES.

UNITED STATES.

CRABS.

Churchill, Edward Perry: Crab industry of Chesapeake Bay. Appendix IV, Report, 1918 (1920), 25 p., XII pl. *Doc. 868 issued Aug. 12, 1919.* F19–36

McMenamin & Co.: Method of catching crabs [in Virginia]. Bulletin, 1884 (1884), vol. IV, p. 48 F18–212

Marsh, Millard Caleb, and John Nathan Cobb: The fisheries of Alaska in 1910. (Crabs: p. 51.) Report and special papers, 1910 (1911), 72 p. *Doc. 746 issued Apr. 19, 1911.* 7–35263

Rathbun, Richard: [The crab fisheries.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXI, p. 629–658.

Roberts, Winthrop A.: The crab industry of Maryland. Appendix. Report, 1904 (1905), p. 415–432. *Doc. 581 issued Sept. 5, 1905.* F10–11

Smith, H. M.: Notes on the crab fishery of Crisfield, Md. Bulletin, 1889 (1891), vol. IX, p. 103–112, pl. 36–41. *Doc. 155 issued June 16, 1891.* F12–143

Smith, Hugh McCormick: Notes on the king-crab fishery of Delaware Bay. Bulletin, 1889 (1891), vol. IX, p. 363–370. *Doc. 166 issued July 17, 1891.* F15-53

U. S. Bureau of Fisheries: [Comparative statistics of the crab product of Maryland and Virginia for various years from 1880 to 1915.] Report, 1916 (1917), p. 64.

——— [Statistics of the crab industry of Maryland and Virginia in 1915.] Report, 1916 (1917), p. 60–64.

CRAWFISH.

Oregonian: [Crawfish trade.] Bulletin, 1894 (1895), vol. XIV, p. 288.

Rathbun, Richard: [The crayfish fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXI, p. 794–797.

Sterling, E.: [How to catch crawfish.] Bulletin, 1886 (1887), vol. VI, p. 457–458.

LOBSTER.

Alexander, Alvin: [Lobster fishery on the Pacific coast.] Report, 1894 (1896), p. 150–151.

Cobb, John Nathan: The lobster fishery of Maine. Bulletin, 1899 (1901), vol. XIX, p. 241–265, illus., pl. 28–32. *Doc. 445 issued Sept. 6, 1900.* F12-83

Field, George Wilton: Lobsters and lobster problem. [With discussion by Henry T. Root, W. H. Boardman, James Donahue, Charles E. Fryer, and Paul North.] Bulletin, 1907 (1908), vol. XXVIII, p. 209–217. *Doc. 653 issued Feb. 12, 1910.* 10-35153

Herrick, Francis H.: The protection of the lobster fishery. Bulletin, 1897 (1898), vol. XVII, p. 217–224. *Doc. 373 issued 1898.* F12-110

Nye, Willard: [Menhaden, herring, eels, and lobsters.] Bulletin, 1884 (1884), vol. IV, p. 312.

Rathbun, Richard: Notes on the decrease of lobsters. Bulletin, 1884 (1884), vol. IV, p. 421–426. F13-118

——— Notes on lobster culture. Bulletin, 1886 (1887), vol. VI, p. 17–32. F18-528

——— [The lobster fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXI, p. 658–794.

——— [The rock-lobster fishery.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXI, p. 798–799.

Smith, A. C.: Notes on the lobster—*Homarus americanus.* Bulletin, 1885 (1885), vol. V, p. 121–125. F18-383

——— [Bait for lobsters.] Bulletin, 1885 (1885), vol. V, p. 111.

Smith, Hugh McCormick: [Lobster fishery of New England.] Report, 1892 (1894), p. CLXXVII–CLXXVIII, p. 130–132.

——— [Spiny lobster fishing of California.] Bulletin, 1894 (1895), vol. XIV, p. 280–281.

Stevenson, Charles Hugh: [Importation of lobsters and other crustaceans.] Report, 1894 (1896), p. 431–571. F11-191

U. S. Bureau of Fisheries: Report of the special commission for the investigation of the lobster and the soft-shell clam. (*Contents*—I. General account of the lobster and clam investigations, by H. M. Smith. II. Experiments in lobster rearing, by G. H. Sherwood. III. The causes of death in artificially reared lobster fry, by Frederic P. Gorham. IV. Conditions governing the existence and growth of the soft-shell clam, *Mya arenaria*, by James L. Kellogg.) Report, 1903 (1904), p. 139–224, pl. I–X. *Doc. 554 issued Jan. 21, 1905.* F11-10

——— [Statistics of the lobster fishery of the Atlantic Coast States in 1913.] Report, 1915 (1917), p. 37–43.

SHRIMP.

Rathbun, Richard: Notes on the shrimp and prawn fisheries of the United States. Bulletin, 1882 (1883), vol. II, p. 139–152. F12-353

——— [The shrimp and prawn fisheries.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXI, p. 799–810.

Townsend, Charles Haskins: [Shrimp fishery of San Francisco Bay.] Report, 1900 (1901), p. 182–183.

U. S. Bureau of Fisheries: [Statistics of the shrimp industry of the South Atlantic and Gulf States in 1916.] Report, 1917 (1919), p. 6–11.

EUROPE.

CRABS.

Crab fisheries proposed in Denmark. Bulletin, 1886 (1887), vol. VI, p. 155–156. F18-564

LOBSTER.

Boeck, Axel, i. e. Jonas Axel: The Norwegian lobster fishery and its history. Report, 1873–74 and 1874–75 (1876), p. 223–258. F16–14

Friele, M.: [Lobster fisheries of Norway in 1877.] Report, 1877 (1879), p. 733–734.

[Lobsters and oysters in Norway.] Bulletin, 1886 (1887), vol. VI, p. 306.

Sars, George Ossian: Lobster fisheries of Norway during the years 1874–1877. Report, 1877 (1879), p. 674–680. F16–112

ASIA.

Japan. Bureau of Agriculture: [The crustacean fisheries of Japan.] Bulletin, 1893 (1894), vol. XIII, p. 433–434.

PRESERVATION.

CRABS.

Churchill, Edward Perry: [Preparation of crabs for market.] Appendix IV, Report, 1918 (1920), p. 19–24.

Smith, Hugh McCormick: [King crab fertilizer.] Bulletin, 1889 (1891), vol. IX, p. 368.

——— Preparation of crab meat. Bulletin, 1889 (1891), vol. IX, p. 111.

LOBSTER.

Cobb, John Nathan: Lobster canning industry. Bulletin, 1889 (1891), vol. IX, p. 255.

SHRIMP.

Macgowan, D. J.: [Preparation of shrimps in China.] Bulletin, 1886 (1887), vol. VI, p. 451.

LEGISLATION FOR LOBSTER.

Boeck, Axel, i. e. Jonas Axel: [Lobster trade and the history of its legislation.] Report, 1873–74 and 1874–75 (1876), p. 32.

Herrick, Francis Hobert: The protection of the lobster fishery. Bulletin, 1897 (1898), vol. XVII, p. 217–224. *Doc. 373 issued Aug. 8, 1898.* F12–110

GEOGRAPHICAL DISTRIBUTION.

UNITED STATES.

GENERAL.

Rathbun, Richard: Natural history of economic crustaceans of the United States. (Extract *from* The fisheries and fishery industries of the United States. 1884. Sec. 1, pt. V, p. 763–830.) *Doc. 224 issued Nov. 15, 1893.* F11–350

Smith, Sidney Irving: Crustacea of the fresh waters of the United States. Report 1872–73 (1874), p. 637–665, III pl. *Doc. 5 issued 1874.* F12–24

——— Report on the decapod crustacea of the *Albatross* dredgings off the east coast of the United States in 1883. Report, 1882 (1884), p. 345–426. *Doc. 78 issued Aug. 15, 1884.* F11–271

——— Report on the decapod crustaceans of the *Albatross* dredgings off the east coast of the United States during the summer and autumn of 1884. Report, 1885 (1887), p. 605–705, XX pl. *Doc. 105 issued Sept. 1, 1886.* F11–250

Verrill, Addison Emory: Report upon the invertebrate animals of Vineyard Sound and adjacent waters, with an account of the physical features of the region. Report, 1871 and 1872 (1873), p. 295–778, XXXVIII pl. F15–102

ALASKA.

Richardson, Harriet: Isopods from the Alaska salmon investigation. Bulletin, 1904 (1905), vol. XXIV, p. 209–221, illus. *Doc. 564 issued Feb. 18, 1905.* F12–8

NORTH CAROLINA.

Hay, William P., and S. A. Shore: The decapod crustaceans of Beaufort, N. C., and the surrounding region. (Bibliography: p. 465–472.) Bulletin, 1915–16 (1918), vol. XXXV, p. 371–475, illus., pl. XXV–XXXIX. *Doc. 859 issued Apr. 6, 1918.* F18–517

TEXAS.

Rathbun, Mary Jane: [List of crustacea collected in Texas in 1891.] Bulletin, 1891 (1893), vol. XI, p. 89–90.

NEW ENGLAND.

Harger, Oscar: Report on the marine isopoda of New England and adjacent waters. Report, 1878 (1880), p. 297–462, pl. I–XIII. *Doc. 32 issued Jan. 27, 1881.* F11–211

Holmes, Samuel Jackson: The Amphipoda of southern New England. Bulletin, 1904 (1905), vol. XXIV, p. 457–541, illus., XIII pl. *Doc. 585 issued Nov. 8, 1905.* F12–14

Verrill, Addison Emory: Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, and of some additions to the fauna of Vineyard Sound. Report, 1882 (1884), p. 641–669. *Doc. 83 issued Aug. 15, 1884.* F11–267

Wheeler, William Morton: The free-swimming copepods of the Woods Hole region. Bulletin, 1899 (1901), vol. XIX, p. 157–192, illus. *Doc. 439 issued Aug. 30, 1900.* F12–92

Wilson, Charles Branch: The fish parasites of the genus Argulus found in the Woods Hole region. Bulletin, 1904 (1905), vol. XXIV, p. 115–131, illus. *Doc. 561 issued Feb. 14, 1905.* F12–5

Wilson, Edmund Beecher: Report on the Pycnogonida of New England and adjacent waters. Report, 1878 (1880), p. 463–506, VII pl. *Doc. 34 issued Jan. 27, 1881.* F16–163

LAKE SUPERIOR.

Forbes, Stephen Alfred: On some Lake Superior Entomostraca. Report, 1887 (1891), p. 701–718, IV pl. *Doc. 174 issued Aug. 24, 1891.* F11–336

PORTO RICO.

Benedict, James E.: The Anomuran collections made by the *Fish Hawk* expedition to Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. II, p. 128–248, illus., pl. 3–6. *Doc. 460 issued Oct. 2, 1901.* F12–253

Bigelow, Maurice Alpheus: The Cirripedia collected near Porto Rico by the *Fish Hawk* expedition in 1898–99. Bulletin, 1900 (1902), vol. XX, pt. II, p. 177–180. *Doc. 463 issued Oct. 2, 1901.* F12–256

Bigelow, Robert Payne: The Stomatopoda of Porto Rica. ("The more important literature on Stomatopoda:" p. 160.) Bulletin, 1900 (1902), vol. XX, pt. II, p. 149–160, illus. *Doc. 461 issued Oct. 2, 1901.* F12–254

Moore, Henry Frank: Report on Porto Rican Isopoda. Bulletin, 1900 (1902), vol. XX, pt. II, p. 161–176, pl. 7–11. *Doc. 462 issued Oct. 2, 1901.* F12–255

Rathbun, Mary Jane: The Brachyura and Macrura of Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. II, p. 1–127, illus., 2 col. pl. *Doc. 459 issued Sept. 26, 1901.* F12–252

JAPAN.

Pilsbry, Henry Augustus: Barnacles of Japan and Bering Sea. Bulletin, 1909 (1911), vol. XXIX, p. 59–84, illus., pl. VIII–XVII. *Doc. 739 issued Feb. 17, 1911.* F11–75

OCEANICA.

HAWAIIAN ISLANDS.

Ortmann, Arnold Edward: Schizopods of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 961–973. *Doc. 588 issued Dec. 28, 1905.* F11–384

Pilsbry, Henry Augustus: Hawaiian Cirripedia. Bulletin, 1906 (1907), vol. XXVI, p. 179–190, pl. IV–V. *Doc. 617 issued Jan. 29, 1907.* F11–65

Rathbun, Mary Jane: The Brachyura and Macurura of the Hawaiian Islands. (Bibliography: p. 929–930.) Bulletin 1903 (1906), vol. XXIII, pt. III, p. 827–930, front., illus., XXIV pl. (partly col.). *Doc. 382 issued 1898.* F11–382

Richardson, Harriet: Isopods collected at the Hawaiian Islands by the United States Fish Commission steamer *Albatross*. (List of references: p. 26.) Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 817–826, illus. *Doc. 542 issued Sept. 17, 1903.* F11–380

PHILIPPINE ISLANDS.

Richardson, Harriet: Marine isopods collected in the Phillippines by the U. S. fisheries steamer *Albatross* in 1907–8. 1910. 44 p., illus. *Doc. 736 issued 1910.* F11–32

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GENERAL.

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Potts, Edward: Fresh-water sponges: what, where, when, and who wants them. Bulletin, 1883 (1883), vol. III, p. 389–391, illus. *Doc. 68 issued Oct. 29, 1883.* F11-313

Verrill, Addison Emory: Report upon the invertebrate animals of Vineyard Sound and adjacent waters, with an account of the physical features of the region. Report, 1871 and 1872 (1873), p. 295–778. F15-102

——— Results of the explorations made by the steamer *Albatross* off the northern coast of the United States in 1883. Report, 1883 (1885), p. 503–699, XLIV pl. *Doc. 99 issued Aug. 16, 1886.* F11-243

Vosmaer, G. C. J.: [Netherland sponges.] Report, 1880 (1883), p. 1019.

Wilson, Henry Van Peters: The sponges collected in Porto Rico in 1899, by the U. S. Fish commission steamer *Fish Hawk*. (Literature references: p. 411.) Bulletin, 1900 (1902) vol. XX, part II, p. 375–411. *Doc. 471 issued Mar. 28, 1902.* F12-418

CULTURE.

Buccich: [Propagating sponges from cuttings.] Report, 1896 (1898), p. 272–275.

Cotte, Jules: Sponge culture. (Bibliography: p. 613–614.) Bulletin, 1908 (1910), vol. XXVIII, p. 587–614. *Doc. 670 issued April, 1910.* 10-35433

Fogarty, J.: [Propagating sponges from clippings.] Report, 1896 (1898), p. 271.

Marenzeller, Emil, edler von: The raising of sponges from cuttings. Report, 1879 (1882), p. 771–777. F17-22

Monroe, Ralph M.: [Account of sponge-cultural experiments in Biscayne Bay.] Report, 1895 (1896), p. 187–188.

Moore, H. Frank: A practical method of sponge culture. Bulletin, 1908 (1910), vol. XXVIII, p. 545–585, illus., pl. LXVII–LXXVI, diagrs. *Doc. 669 issued Apr. 4, 1910.* 10-35434

Rathbun, Richard: [Reproduction in sponges.] Report, 1889–1891 (1893), p. 167.

Smith, Hugh McCormick: [Cultivation of sponges from cuttings.] Bulletin, 1897 (1898), vol. XVII, p. 236–238.

——— [Sponge planting experiments.] Report, 1901 (1902), p. 122–123; 1902 (1904), p. 125–127; 1903 (1905), p. 86–88.

U. S. Commissioner of Fisheries: [Propagating sponges from cuttings.] Report, 1878 (1880), p. XLIV–XLV.

——— Experiments in sponge culture. Report, 1905 (1907), p. 22; 1906 (1908), p. 13; 1907 (1909), p. 11–12; 1908 (1910), p. 10; 1909 (1911), p. 14–15; 1910 (1911), p. 17–18.

Wilson, Henry Van Peters: On the feasibility of raising sponges from the egg. Bulletin, 1897 (1898), vol. XVII, p. 241–245. *Doc. 375 issued Aug. 8, 1898.* F12-110

——— Development of sponges from tissue cells outside the body of the parent. Bulletin, 1908 (1910), vol. XXVIII, p. 1265–1271. *Doc. 717 issued May 5, 1910.* 10-35648

——— Development of sponges from dissociated tissue cells. Bulletin, 1910 (1912), vol. XXX, p. 1–30, pl. I–V. *Doc. 750 issued June 16, 1911.* F11-220

FISHERIES.

Arapian, E. J.: [Florida sponge fisheries.] Report, 1896 (1898), p. 276–278.

Brice, John J.: [Commercial sponges of Florida.] Report, 1896 (1898), p. 266–271.

Cobb, John Nathan: The sponge fisheries of Florida in 1900. Report, 1902 (1904), p. 161–175, pl. 6–9. *Doc. 535 issued Sept. 21, 1903.* F11-2

Collins, Joseph William: [Sponge fisheries of Key West.] Report, 1885 (1887), p. 246–258.

Flégel, Charles: The abuse of the scaphander in the sponge fisheries. Bulletin, 1908 (1910), vol. XXVIII, p. 513–543. *Doc. 668 issued March, 1910.* 10–35432

Grady, John E.: [Sponge fishing near Appalachicola, Fla.] Bulletin, 1886 (1887), vol. VI, p. 140.

Moore, Henry Frank: The commercial sponges and the sponge fisheries. (Bibliography: p. 511.) Bulletin, 1908 (1910), vol. XXVIII, p. 399–511, illus., pl. XXVIII–LXVI. *Doc. 667 issued Mar. 28, 1910.* 10–35431

Rathbun, Richard: The sponge fishery and trade. *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXIII, p. 817–841.

Ruge, J. G.: The sponge fisheries of Florida. Bulletin, 1887 (1889), vol. VII, p. 22–24. F18–641.

Smith, Hugh McCormick: [Sponge fishery of Biscayne Bay, Florida.] Report, 1895 (1896), p. 180–182.

——— The Florida commercial sponges. Bulletin, 1897 (1898), vol. XVII, p. 225–240, pl. 12–31. *Doc. 374 issued Aug. 5, 1898.* F12–110

——— Notes on the Florida sponge fishery in 1899. Bulletin, 1899 (1901), vol. XIX, p. 149–151. *Doc. 437 issued Aug. 30, 1900.* F12–29

Stevenson, Charles Hugh: [Foreign trade in sponges.] Report, 1894 (1896), p. 542–545.

U. S. Bureau of Fisheries: [Sponge fishery of the Gulf States.] Report, 1899 (1900), p. 126.

——— [Sponge fishery of Florida.] Report, 1901 (1902), p. 156.

——— [Florida sponge fisheries.] Report, 1913 (1914), p. 68–69.

LEGISLATION.

Law unenforceable. Report, 1910 (1911), p. 37; 1911 (1913), p. 53; 1913 (1914), p. 68,

Sponge law. (Act of June 20, 1906). Report, 1910 (1911), p. 37–38; 1911 (1913), p. 52.

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Forbes, Stephen Alfred: Preliminary report upon the invertebrate animals inhabiting Lakes Geneva and Mendota, Wisconsin, with an account of the fish epidemic in Lake Mendota in 1884. Bulletin, 1888 (1890), vol. VIII, p. 473–487. *Doc. 147 issued Mar. 25, 1891.* F11–328

——— A preliminary report on the aquatic invertebrate fauna of the Yellowstone national park, Wyoming, and of the Flathead region of Montana. Bulletin, 1891 (1893), vol. XI, p. 207–258, pl. XXXVII–XLII. *Doc. 210 issued Apr. 28, 1893.* F12–126

Martens, J. B.: Life in the sea. Bulletin, 1882 (1883), vol. II, p. 253–265. F12–362

Needham, James G.: Burrowing mayflies of our larger lakes and streams. (Bibliography: p. 289–291.) Bulletin, 1917–18 (1921), vol. XXXVI, p. 265–293, pl. LXX–LXXXII. *Doc. 883 issued July 17, 1920.* F20–154

Smith, Sidney Irving: Sketch of the invertebrate fauna of Lake Superior. Report, 1872–73 (1874), p. 690–707. *Doc. 6 issued 1874.* F12–215

Sumner, Francis Bartody: An intensive study of the fauna and flora of a restricted area of sea bottom. Bulletin, 1908 (1910), vol. XXVIII, p. 1225–1263, charts (1 fold.), fold. diagr. *Doc. 716 issued May 14, 1910.* 10–35677

——— A biological survey of the waters of Woods Hole and vicinity. Section III. A catalogue of the marine fauna of Woods Hole and vicinity. (Bibliography: p. 782–794.) Bulletin, 1911 (1913), vol. XXXI, p. 545–794.

U. S. Bureau of Fisheries: List of collections made by the fishing vessels of Gloucester and other New England seaports for the United States Fish commission from 1877 to 1880. Report, 1879 (1882), p. 787–835. F17–23

U. S. Fisheries Biological Laboratory, Woods Hole: Biological notes no. 1. Bulletin, 1899 (1901), vol. XIX, p. 305–310. *Doc. 447 issued Aug. 30, 1900.* 7–3152

Verrill, Addison Emory, and S. I. Smith: Report upon the invertebrate animals of Vineyard Sound and adjacent waters, with an account of the physical features of the region. Report, 1871 and 1872 (1873), p. 295–778. F15–102

——— Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, and of some additions to the fauna of Vineyard Sound. Report, 1882 (1884), p. 641–669. *Doc. 83 issued Aug. 15, 1884.* F11–267

Wilson, Charles Branch: Dragonflies and damselflies in relation to pondfish culture, with a list of those found near Fairport, Iowa. (Bibliography: p. 260–264.) Bulletin, 1917–18 (1921), vol. XXXVI, p. 179–264, illus., pl. LXVII. *Doc. 882 issued Aug. 4, 1920.* F20–160

PROTOZOA.

Calkins, Gary Nathan: Marine Protozoa from Woods Hole. (List of references: p. 466–468.) Bulletin, 1901 (1902), vol. XXI, p. 413–468, illus. *Doc. 502 issued Oct. 21, 1902.* F12–262

Certes, A.: Note upon the effect of high pressure on the vitality of minute fresh-water and salt-water organisms. Bulletin, 1884 (1884), vol. IV, p. 433–435. F18–358

Flint, James Milton: The Foraminifera of Porto Rico. Bulletin, 1900 (1902), vol. XX, part II, p. 413–416. *Doc. 484 issued Mar. 28, 1902.* F12–265

Gurley, R. R.: On the classification of the Myxosporidia, a group of protozoan parasites infesting fishes. Bulletin, 1891 (1893), vol. XI, p. 407–420. *Doc. 215 issued July 14, 1893.* F12–157

Jennings, Herbert Spencer: A report of work on the Protozoa of Lake Erie, with special reference to the laws of their movements. Bulletin, 1899 (1901), vol. XIX, p. 105–114. *Doc. 435 issued Aug. 30, 1899.* F12–47

Linton, Edwin: On certain wart-like excrescences occurring on the short minnow, *Cyprinodon variegatus*, due to psorosperms. Bulletin, 1889 (1891), vol. IX, p. 99–102. *Doc. 154 issued June 11, 1891.* F12–142

——— Notice of the occurrence of protozoan parasites (psorosperms) on cyprinoid fishes in Ohio. Bulletin, 1889 (1891), vol. IX, p. 359–361, pl. CXX. *Doc. 165 issued July 7, 1891.* F12–153

Stiles, Charles Wardell: Report on a parasitic protozoan observed on fish in the aquarium of the U. S. Fish commission at the World's fair. (Bibliography: p. 175.) Bulletin, 1893 (1894), vol. XIII, p. 173–190. *Doc. 253 issued 1894.* F12–183

COELENTERATA.

Collins, Joseph William: On the occurrence of corals on the Grand Banks. Bulletin, 1884 (1884), vol. IV, p. 237. F18–295

Duerden, James Edwin: Report on the actinians of Porto Rico. (References: p. 370–371.) Bulletin, 1900 (1902), vol. XX, pt. II, p. 321–374, XII pls. *Doc. 470 issued Apr. 7, 1902.* F12–261

Fewkes, Jesse Walter: Report on the Medusæ collected by the U. S. Fish commission steamer *Albatross* in the region of the Gulf Stream in 1883–84. Report, 1884 (1886), p. 927–980, X pl. *Doc. 113 issued Dec. 1, 1886.* F11–260

——— Report on the Medusæ collected by the U. S. Fish commission steamer *Albatross* in the region of the Gulf Stream in 1885 and 1886. Report, 1886 (1889), p. 513–536. *Doc. 129 issued May 24, 1889.* F11–256

Fraser, C. McLean: Some hydroids of Beaufort, North Carolina. (Bibliography: p. 384–387.) Bulletin, 1910 (1912), vol. XXX, p. 337–387, illus. *Doc. 762 issued July 25, 1912.* F12–201

Hargitt, Charles Wesley: The Anthrozoa of the Woods Hole region. (Literature cited: p. 252–253.) Bulletin, 1902 (1903), vol. XXXII, p. 223–254, illus., pl. XLI–XLIV (part. col.). *Doc. 788 issued Apr. 25, 1914.* F14–45

——— The Medusæ of the Woods Hole region. (Literature cited: p. 73–75.) Bulletin, 1904 (1905), vol. XXIV, p. 21–79, illus., VII col. pl. *Doc. 558 issued Feb. 14, 1905.* F12–2

Hargitt, Charles Wesley, and Charles G. Rogers: The Alcyonaria of Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. II, p. 265–287, illus., IV pls. *Doc. 468 issued Dec. 12, 1901.* F12–260

Mayer, Alfred Goldsborough: Medusæ of the Hawaiian Islands collected by the steamer *Albatross* in 1902. (Bibliography: p. 1142–1143.) Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 1131–1143, III pl. *Doc. 600 issued June 30, 1906.* F11–387

Nutting, Charles Cleveland: The hydroids of the Woods Hole region. Bulletin, 1899 (1901), vol. XIX, p. 325–386, illus. *Doc. 455 issued June 10, 1901.* F12–90

——— Hydroids of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 931–959, XIII pl. *Doc. 586 issued Dec. 23, 1905.* F11–383

Vaughan, Thomas Wayland: The stony corals of the Porto Rican waters. Bulletin, 1900 (1902), vol. XX, pt. II, p. 289–320, XXXVIII pls. *Doc. 469 issued Dec. 14, 1901.* F12–415

PLATHELMINTHES.

Coe, Wesley Roswell: The nemerteans of Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. II, p. 222–229. *Doc. 466 issued Oct. 8, 1901.* F12–258

——— The nemerteans of the Hawaiian Islands collected by the steamer *Albatross* in 1902. Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 975–986, illus., pl. *Doc. 589 issued Mar. 14, 1906.* F11–385

Danglade, Ernest: The flatworm as an enemy of Florida oysters. Appendix X, Report, 1918 (1920), 8 p., II pl. *Doc. 869 issued June 20, 1919.* F19–30

Linton, Edwin: Notes on Entozoa of marine fishes of New England, with descriptions of several new species. Report, 1886 (1889), p. 453–511, VI pl. *Doc. 128 issued 1889.* F11–255

——— On two species of larval Dibothria from the Yellowstone national park. Bulletin, 1889 (1891), vol. IX, p. 65–79, pl. XXIII–XXVII. *Doc. 150 issued June 5, 1891.* F12–138

——— Notes on Entozoa of marine fishes of New England, with descriptions of several new species. Part II. Report, 1887 (1891), p. 719–900, XV pl. *Doc. 175 issued Aug. 24, 1891.* F11–337

Linton, Edwin: Notes on the Entozoa of marine fishes, with descriptions of new species. Part III. Report, 1888-89 (1892), p. 523-542, pl. LIII-LX. *Doc. 182 issued July 1, 1892.* F12-224

——— The anatomy of *Thysanocephalum crispum* Linton, a parasite of the tiger shark. Report, 1888-89 (1892), p. 543-556, pl. LXI-LXVII. *Doc. 183 issued July 2, 1892.* F12-225

——— Fish Entozoa from Yellowstone national park. Report, 1889-1891 (1893), p. 545-564, pl. 63-67. *Doc. 220 issued Oct. 25, 1893.* F12-230

ROTIFERA.

Jennings, Herbert Spencer: Rotatoria of the United States, with especial reference to those of the Great Lakes. (Literature cited: p. 102.) Bulletin, 1899 (1901), vol. XIX, p. 67-104, pl. 14-22. *Doc. 434 issued Aug. 30, 1900.* F12-46

——— Rotatoria of the United States. II. A monograph of the Rattulidæ. (Literature cited: p. 345-347.) Bulletin, 1902 (1904), vol. XXII, p. 273-352, illus., XV pl. *Doc. 528 issued July 23, 1903.* F12-67

COELHELMINTHES.

Eisen, Gustav: Oligochætological researches. Report, 1883 (1885), p. 879-964, XIX pl. *Doc. 101 issued Aug. 16, 1886.* F11-245

Hessel, Rudolph: Artificial culture of medicinal leeches and of species of Helix. Bulletin, 1881 (1882), vol. I, p. 264-265. F18-51

——— Leech culture. Bulletin, 1884 (1884), vol. IV, p. 175-176. F18-269

Linton, Edwin: [Notes on nematodes which have been collected in successive years in the waters of southern New England.] Bulletin, 1899 (1901), vol. XIX, p. 405-492.

Moore, John Percy: Descriptions of two new leeches from Porto Rico. (List of papers cited: p. 221.) Bulletin, 1900 (1902), vol. XX, pt. II, p. 211-222, pl. 13-14. *Doc. 465 issued Oct. 4, 1901.* F12-257

——— Hirudinea and Oligochæta collected in the Great Lakes region. Bulletin, 1905 (1906), vol. XXV, p. 153-171, illus., pl. XXXII (col.). *Doc. 598 issued Aug. 25, 1906.* F11-69

Osburn, Raymond C.: The Bryozoa of the Woods Hole region. Bulletin, 1910 (1912), vol. XXX, p. 203-266, pl. XVIII-XXXI. *Doc. 760 issued June 25, 1912.* F12-170

Rathbun, Richard: [The leech industry.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXII, p. 811-815.

Treadwell, Aaron Louis: The polychaetous annelids of Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. II, p. 181-210, illus. *Doc. 464 issued Oct. 4, 1901.* F12-414

——— Polychaetous annelids of the Hawaiian Islands, collected by the steamer *Albatross* in 1902. Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 1145-1181, illus. *Doc. 388 issued Aug. 8, 1898.* F11-388

Verrill, Addison Emory: Synopsis of North American fresh-water leeches. Report, 1872-73 (1874), p. 666-689. *Doc. 8 issued 1874.* F12-217

Webster, H. E., and James E. Benedict: The annelida Chaetopoda from Provincetown and Wellfleet, Massachusetts. Report, 1881 (1884), p. 699-747, VIII pl. *Doc. 68 issued Apr. 19, 1884.* F11-310

——— The annelida Chaetopoda from Eastport, Maine. Report, 1885 (1887), p. 707-758, VIII pl. *Doc. 117 issued Oct. 31, 1887.* F11-284

ECHINODERMA.

Clark, Hubert Lyman: The synaptas of the New England coast. (Literature consulted: p. 31.) Bulletin, 1899 (1901), vol. XIX, p. 21-31, pl. 10-11 (partly col.). *Doc. 426 issued Dec. 13, 1899.* F12-42

——— The echinoderms of Porto Rico. Bulletin, 1900 (1902), vol. XX, pt. II, p. 231-263, pl. 14-17. *Doc. 467 issued Oct. 4, 1901.* F12-259

——— The echinoderms of the Woods Hole region. ("List of publications referring to the echinoderms of the Woods Hole region, or to which reference is made in the preceding pages": p. 572-574.) Bulletin, 1902 (1904), vol. XXII, p. 545-576, 14 pl. *Doc. 550 issued June 25, 1904.* F12-76 Rev.

Fisher, Walter Kenrick: The starfishes of the Hawaiian Islands. (Bibliography: p. 1120-1121.) Bulletin, 1903 (1906), vol. XXIII, pt. III, p. 987-1130, illus., XLIX pl. *Doc. 599 issued June 30, 1906.* F11-386

——— New starfishes from deep water off California and Alaska. Bulletin, 1904 (1905), vol. XXIV, p. 291-320. *Doc. 572 issued June 10, 1905.* F12-11

Mead, Albert Davis: The natural history of the starfish. Bulletin, 1899 (1901), vol. XIX, p. 203–224, pl. 23–26. *Doc. 441 issued Aug. 29, 1900.* F12–89

Rathbun, Richard: [The trepang fishery at Key West.] *In* The fisheries and fishery industries of the United States. 1887. Sec. V, vol. 2, pt. XXII, p. 815–816.

Swan, James Gilchrist: The trepang fishery. Bulletin, 1886 (1887), vol. VI, p. 333–334. F18–604

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[The **Fish-catching** bladderwort (Utricularia).] Bulletin, 1884 (1884), vol. IV, p. 456.

Forbes, Stephen Alfred: Destruction of fish-food by bladderwort (Utricularia). Bulletin, 1884 (1884), vol. IV, p. 443. F18–360

Halperine, E.: Piscivorous plants. Bulletin, 1885 (1885), vol. V, p. 353–356. F18–471

Moseley, Henry Nottidge: A carnivorous plant preying on Vertebrata. Bulletin, 1884 (1884), vol. IV, p. 259–260. F18–304

——— The fish-eating Utricularia, or bladderwort. Bulletin, 1884 (1884), vol. IV, p. 261. F18–305

Simms, George E.: A fish-eating plant. Bulletin, 1884 (1884), vol. IV, p. 257–259. F18–303

PHYSIOGRAPHIC REGIONS.

FRESH WATER.

Brakeley, John H.: [Plants for carp ponds.] Bulletin, 1884 (1884), vol. IV, p. 159–160.

Doolittle, A. A.: [The plankton environment: p. 65–77.] *In* Fishes of Connecticut lakes and neighboring waters . . . by W. C. Kendall and E. L. Goldsborough. Report and special papers, 1907 (1908), map, chart. *Doc. 633 issued July 6, 1908.* 8–35558

Hessel, Rudolph: [Grass for carp ponds.] Bulletin, 1885 (1885), vol. V, p. 341.

Johnson, Robert Sidney: Fish ponds on farms. (Aquatic plants and their value in pond fish-culture: p. 15–16.) Appendix II, Report, 1915 (1917), 28 p. *Doc. 826 issued Dec. 15, 1915.* F16–79

Moore, Emmeline: The Potamogetons in relation to pond culture. Bulletin, 1913 (1915), vol. XXXIII, p. 251–291, pl. XXII–XXXIX. *Doc. 815 issued July 28, 1915.* F15–84

——— Some plants of importance in pond-fish culture. (Bibliography: p. 19–20.) Appendix IV, Report, 1919 (1921), 20 p., fold. chart. *Doc. 881 issued Mar. 24, 1920.* F20–108

Pieters, Adrian John: The plants of western Lake Erie, with observations on their distribution. Bulletin, 1901 (1902), vol. XXI, p. 57–79, illus., pl. 11–20. *Doc. 479 issued Oct. 18, 1901.* F12–33

Pond, Raymond Haines: The biological relation of aquatic plants to the substratum. Report, 1903 (1905), p. 483–526. *Doc. 566 issued 1905.* F11–13

Titcomb, John W.: Aquatic plants in pond culture. Report and special papers, 1907 (1909), 31 p., pls., illus. *Doc. 643 issued Feb. 8, 1909.* 9–35225

U. S. Bureau of Fisheries: [Plants and seeds received at the carp ponds.] Bulletin, 1885 (1885), vol. V, p. 339.

——— [*Zizania acquatica* for Germany.] Bulletin, 1885 (1885), vol. V, p. 465.

Ward, Lester Frank: List of water plants for carp ponds. Bulletin, 1882 (1883), vol. II, p. 22–23. F12–342

——— Marsh and aquatic plants of the northern United States, many of which are suitable for carp ponds. Bulletin, 1883 (1883), vol. III, p. 257–265. F12–395.

Yoakum, F. L.: [Water plants in carp culture.] Bulletin, 1882 (1883), vol. II, p. 28–30.

SALT WATER.

Davis, Bradley Moore: A biological survey of the waters of Woods Hole and vicinity Section II. Botanical. General characteristics of the algal vegetation of Buzzards Bay and Vineyard Sound in the vicinity of Woods Hole. (Literature cited: p. 497.) Section IV. A catalogue of marine flora of Woods Hole and vicinity. (Bibliography for floral catalogue: p. 832–833.) Bulletin, 1911 (1913), vol. XXXI, p. 443–544 incl. tables and charts: p. 795–833.

Farlow William Gibson: List of the sea-weeds or marine algæ of the south coast of New England. Report, 1871 and 1872 (1873), p. 281–293. F17–48

——— List of marine algæ in the United States. Report, 1875–76 (1878), 28 p. *Doc. 14 issued July, 1876.* F11–207

——— Marine algæ of New England and adjacent coasts. (Bibliography: p. 192–197.) Report, 1879 (1882), 210 p., XV pl. *Doc. 36 issued 1881.* F11–213

Hoyt, W. D.: Marine algæ of Beaufort, N. C., and adjacent regions. (Bibliography: p. 539–547.) Bulletin 1917–18 (1921), vol. XXXVI, p. 367–556, v p., illus., pl. LXXXIV–CXIX. *Doc. 886 issued Dec. 30, 1920.* F21–3

Martens, J.: Life in the sea. Bulletin, 1882 (1883), vol. II, p. 253–264. F12–362

Sumner, Francis Bertody: An intensive study of the fauna and flora of a restricted area of sea bottom. Bulletin, 1908 (1910), vol. XXVIII, p. 1225–1263, charts (1 fold.), fold. diagr. *Doc. 716 issued May 14, 1910.* 10–35677

ALGÆ.

Edwards, Vinal N.: [Notes upon fish and other objects on Cape Cod.] Bulletin, 1885 (1885), vol. V, p. 69.

Marsh, Millard Caleb: The treatment of fish-cultural waters for the removal of algæ. Bulletin, 1908 (1910), vol. XXVIII, p. 871–890, illus. *Doc. 687 issued April, 1910.* 10–35567

Snow, Julia W.: The plankton algæ of Lake Erie, with special reference to the Chlorophyceæ. (Literature: p. 393.) Bulletin, 1902 (1904), vol. XXII, p. 369–394, IV col. pls. *Doc. 529 issued Aug. 4, 1903.* F12–69

DIATOMS.

Gorham, Frederic Poole: [Life-history of diatoms and their relation to lobster-fry.] Report, 1903 (1905), p. 176–193, pl. IV–VI.

Lotsy, Johannes Paulus: Food of the oyster, clam, and ribbed mussel. Report, 1893 (1895), p. 375–386. *Doc. 313 issued 1896.* 6–44419

Mitchell, Philip Henry, and Raymond L. Barney: The occurrence in Virginia of green-gilled oysters similar to those of Marennes. (Bibliography: p. 149.) Bulletin, 1915–16 (1918), vol. XXXV, p. 137–149. *Doc. 850 issued Aug. 11, 1917.* F17–247

Puységur, M., and John A. Ryder: [On the cause of the greening of oysters, by M. Puységur, with a supplementary note on the coloration of the blood-corpuscles of the oyster by John A. Ryder.] Report, 1882 (1884), p. 793–805.

Ryder, John A.: [Deposits from seawater in Woods Hole Harbor.] Bulletin, 1885 (1885), vol. V, p. 68–69.

COMMERCIAL USE.

Clark, A. Howard: [Irish moss industry.] *In* The fisheries and fishery industries of the United States. 1887. Sec. II, pt. III, p. 219–220.

Hoyt, W. D.: [Economic uses of algæ.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 405.

Japan, Bureau of Agriculture: [Utilization of algæ.] Bulletin, 1893 (1894), vol. XIII, p. 434–435.

Smith, Hugh McCormick: The seaweed industries of Japan. The utilization of seaweeds in the United States. (References: p. 136.) Bulletin, 1904 (1905), vol. XXIV, p. 133–181, illus., V pl. *Doc. 562 issued Feb. 18, 1905.* F12–6

Stevenson, Charles Hugh: [Aquatic plants as fertilizer.] Report, 1902 (1903), p. 275–279.

Swan, James G.: [A preparation from the giant kelp of the Pacific.] Bulletin, 1886 (1887), vol. VI, p. 452.

——— [On the economic value of the giant kelp and other seaweeds of the northwest coast of North America.] Bulletin, 1893 (1894), vol. XIII, p. 371–376.

——— [A new gelatinous substance.] Bulletin, 1893 (1894), vol. XIII, p. 373–375.

U. S. Bureau of Fisheries: [Irish moss industry.] Report, 1904 (1905), p. 285–286.

White, George F., and Adrian Thomas: Properties of fish and vegetable oil mixtures. Bulletin, 1912 (1913), vol. XXXII, p. 183–198, illus. *Doc. 785 issued Feb. 18, 1914.* F14–8

BACTERIA.

Clark, A. Howard: [To prevent fish from reddening.] Bulletin, 1885 (1885), vol. V, p. 79.

Cobb, John Nathan: [Reddening of cod.] Appendix IV, Report, 1915 (1917), p. 75–79.

Farlow, William G.: On the nature of the peculiar reddening of salted codfish during the summer season. Report, 1878 (1880), p. 969–974. F20–120

——— Vegetable parasites of codfish. Bulletin, 1886 (1887), vol. VI, p. 1–4. F18–521

——— [Vegetable parasites on codfish and salt pork.] Bulletin, 1886 (1887), vol. VI, p. 318.

Lawrence-Hamilton, J.: Foul fish and filth fevers. Bulletin, 1893 (1894), vol. XIII, p. 311–334. *Doc. 269 issued 1894.* F12–183

Layet, Alexandre: Experimental hygiene—Observations on the red flesh of the codfish. Bulletin, 1887 (1889), vol. VII, p. 90–95. F18–656

Mauriac, E.: Cases of poisoning caused by spoiled codfish, and the unnecessary prohibition of the sale of reddened codfish. Report, 1886 (1889), p. 1027–1053 F17–151

Stevenson, Charles H.: [Reddening of salted cod.] Bulletin, 1898 (1899), vol. XVIII, p. 399.

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[**Analysis** of codfish—fresh, salt, and klipfish.] Report, 1885 (1887), p. 326.

Atwater, Wilber Olin: [Menhaden and other fish and their products as related to agriculture.] Report, 1877 (1879), p. 194–226.

——— Report of progress of an investigation of the chemical composition and economic values of fish and invertebrates used for food. Undertaken for the United States Fish commission. Report, 1880 (1883), p. 231–285 incl. tables. F16–273

——— Tables illustrative of the nutritive value of fish. Bulletin, 1884 (1884), vol. IV, p. 203–205. F13–97

——— Report of analysis of a sample of fish guano made from salmon offal, by Mr. Joseph Spratt, of Victoria, British Columbia. Bulletin, 1884 (1884), vol. IV, p. 238. F13–103

——— Contributions to the knowledge of the chemical composition and nutritive values of American food fishes and invertebrates. Report, 1883 (1885), p. 433–499 incl. tables. *Doc. 98 issued Aug. 16, 1886.* F11–242

——— The chemical composition and nutritive value of food-fishes and aquatic invertebrates. Report, 1888–89 (1892), p. 679–868 incl. tables, 9 fold. col. diagr. *Doc. 185 issued June 2, 1892.* Agr. 3–567

Chittenden, R. H., and George W. Cummins: On the relative digestibility of fish flesh in gastric juice. Report, 1884 (1886), p. 1109–1122. F17–138

Cobb, John Nathan: Pacific cod fisheries. (Comparative analysis of Pacific and Atlantic cod: p. 76.) Appendix IV, Report, 1915 (1917), 111 p., IX pl., chart. *Doc. 830 issued Oct. 23, 1916.* F16–191

Coker, Robert Ervin: [Dry mussel meat as food for poultry or fish.] Bulletin, 1917–18 (1921), vol. XXXVI, p. 62.

Fuller, Caleb Allen: [Bacteriological analysis of shellfish from Narragansett Bay.] Report, 1904 (1905), p. 218–236.

Green, Erik H.: The chemical composition of the subdermal connective tissue of the ocean sun-fish. Bulletin, 1899 (1901), vol. XIX, p. 321–324. *Doc. 449 issued Aug. 31, 1900.* F12–84

Green, Erik H., and Ralph Winfred Tower: The organic constituents of the scales of fish. Bulletin, 1901 (1902), vol. XXI, p. 97–102. *Doc. 496 issued May 26, 1902.* F12–272

Kensington, Edward Thomas: [Composition of the roe of the salmon.] Bulletin, 1884 (1884), vol. IV, p. 74.

——— Composition of some of the food-fishes. Bulletin, 1884 (1884), vol. IV, p. 74–75. F18–225

Kostytscheff, P. A.: Chemical composition of fish products, with some remarks on their nutritive value. Report, 1886 (1889), p. 1019–1025. F17–149

Levene, Phoebus Aaron Theodore: Some chemical changes in the developing fish egg. Bulletin, 1899 (1901), vol. XIX, p. 153–155. *Doc. 438 issued Aug. 31, 1900.* F12–86

Ryder, John Adam: [Analysis of the Portuguese and common oyster.] Bulletin, 1882 (1883), vol. II, p. 319–338.

Smith, Albert W.: [Composition of the shell and gastroliths of the lobster.] Bulletin, 1895 (1896), vol. XV, p. 227–228

Tower, Ralph Winfred: The gas in the swim-bladder of fishes. Bulletin, 1901 (1902), vol. XXI, p. 125–136. *Doc. 498 issued May 23, 1902.* F12–413

White, George F., and Adrian Thomas: A new method for the determination of the food value of proteins, with application to *Cynoscion regalis.* Bulletin, 1912 (1913), vol. XXXII, p. 175–181, illus. *Doc. 784 issued Feb. 18, 1914.* F14–5

WATER.

Fuller, Cabel Allen: [Bacteriological analysis of water samples from Narragansett Bay.] Report, 1904 (1905), p. 207–218.

Hoffman, R. E.: Artificial sea-water for aquaria. Bulletin, 1884 (1884), vol. IV, p. 465–467. F13–76

Kidder, J. H.: Report upon the water supply of the Fish commission station at Woods Hole, Mass. Report, 1884 (1886), p. 215–221, illus., fold. pl. F17–124

——— Memorandum on water residues from cod-hatching station at Woods Hole. Bulletin, 1885 (1885), vol. V, p. 357. F18–473

Marsh, Millard Caleb: [Nitrogen and oxygen content at Nashua.] Report, 1904 (1905), p. 374.

Rathbun, Richard: [Analysis of water of Long Island Sound.] Report, 1889–1891 (1893), p. 118–119.

Taylor, Fred W.: Analysis of artesian-well water from the shad-hatching station at Havre de Grace, Md. Bulletin, 1883 (1883), vol. III, p. 348. F18–145

U. S. Bureau of Chemistry: [Analysis of water: p. 14–15.] *In* Devils Lake, North Dakota, by T. E. B. Pope. Report and special papers, 1907 (1909), 22 p. *Doc. 634 issued July 16, 1908.*

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Baird, Spencer Fullerton: Circulars in reference to shipping fresh fish and other animals. 4 p. *Doc. 29 issued 1881.* F14–135

——— The instruction of naval midshipmen in taxidermy, ichthyology, etc., at the U. S. National museum and on board the steamers of the United States Fish commission. Bulletin, 1883 (1883), vol. III, p. 239. F12–394

——— On the specimens received by the Smithsonian institution from the United States Life-saving service. Bulletin, 1884 (1884), vol. IV, p. 177–178. F13–93

Bean, Tarleton Hoffman: List of fishes distributed by the United States Fish commission. Report, 1882 (1884), p. 1039–1044. F16–307

Ryder, John Adam: Directions for collecting embiotocoid fish embryos. Bulletin, 1885 (1885), vol. V, p. 32. F18–369

Smiley, Charles Wesley: Arrangement with the life-saving service and the lighthouse board for collecting whales, porpoise, sharks, and strange forms of marine life. Bulletin, 1884 (1884), vol. IV, p. 385–387. F18–343

U. S. Bureau of Fisheries: Distribution of duplicate sets of marine invertebrates, 1879–1886. Report, 1886 (1889), p. 843–867.

PRESERVATION.

Bean, Tarleton Hoffman: Directions for collecting and preserving fish. 1881, 6 p. *Doc. 30 issued 1881.* F12–211

——— Directions for collecting and preserving fish. Bulletin, 1883 (1883), vol. III, p. 197–200. F12–211

Brooks, William Keith: [New method for preserving delicate organisms.] *Quoted by* Ryder. Report, 1888–89 (1891), p. 519.

Figgins, J. D.: New methods of preparing fishes for museum exhibit. Bulletin, 1908 (1910), vol. XXVIII, p. 1357–1368. *Doc. 724 issued 1910.* 10–35653

Franklin, Dwight: A method of preparing fish for museum and exhibition purposes. Bulletin, 1908 (1910), vol. XXVIII, p. 1353–1355, pl. CXLII. *Doc. 723 issued 1910.*

Holder, Charles Frederick: A plan for an educational exhibit of fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1309–1314. *Doc. 720 issued May, 1910.* 10–35651

Lucas, Frederic Augustus: Outline of educational exhibit of fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1341–1351. *Doc. 722 issued 1910.* 10–35678

Miner, Roy Waldo: A plan for an educational exhibit of fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1215–1340, pl. CXXVI–CXLI. *Doc. 721 issued May 20, 1910.*

Ryder, John Adam: On the preservation of embryonic materials and small organisms, together with hints upon embedding and mounting sections serially. Report, 1882 (1884), p. 607–628. *Doc. 76 issued Aug. 12, 1884.* F11–274

Seal, William P.: The keeping of Salmonidæ for purposes of exhibition. Bulletin, 1887 (1889), vol. VII, p. 283–285, illus. F18–676

Tanner, Zera Luther: [Preparation and preservation of specimens.] Bulletin, 1896 (1897), vol. XVI, p. 404–417.

TECHNIQUE.

Crozier, William J., and Selig Hecht: Correlation of weight, length, and other body measurements in the weakfish, *Cynoscion regalis*. Bulletin, 1913 (1915), vol. XXXIII, p. 141–147, illus. *Doc. 800 issued Sept. 17, 1914.* F14–101

Snyder, John Otterbein: [Diagram for taking measurements of fish.] Bulletin, 1907 (1908), vol. XXVII, p. 79, illus.

AQUARIUMS.

Blake, William Phipps: A report to the United States Centennial commission upon the principal aquariums abroad in 1873. Report, 1882 (1884), p. 631–640, illus. F16–308

Forbes, S. A.: The aquarium of the U. S. Fish commission at the World's Columbian exposition. Report of the Director. Bulletin, 1893 (1894), vol. XIII, p. 143–158. *Doc. 253 issued June 26, 1894.* F12–183

Hoffman, R. E.: Artificial sea-water for aquaria. Bulletin, 1884 (1884), vol. IV, p. 465–467. F13–76

Holder, Charles Frederick: A method of transporting live fishes. Bulletin, 1908 (1910), vol. XXVIII, p. 1005–1007. *Doc. 702 issued Apr., 1910.* 10–35427

Norsk Fiskeritidende: [Purifying water in glass aquariums.] Bulletin, 1886 (1887), vol. VI, p. 401.

Reeves, I. S. K.: Description of the fresh and salt-water supply and pumping plants used for the aquarium. Bulletin, 1893 (1894), vol. XIII, p. 159–161. *Doc. 253 issued June 26, 1894.* F12–183

Ryder, John Adam: [Improvements in methods of display.] Report, 1888–89 (1892), p. 521.

Seal, William P.: The aqua-vivarium as an aid to biological research. Report, 1883 (1885), p. 965–969. *Doc. 102 issued Aug. 16, 1886.* F11–246

——— The aquarium. A brief exposition of its principles and management. Bulletin, 1887 (1889), vol. VII, p. 274–282. F11–331

——— An inquiry as to the proper methods for the care of living things held for popular amusement and instruction or for purposes of biological research. Bulletin, 1887 (1889), vol. VII, p. 285–287, pl. I–II. F18–677

——— Observations on the aquaria of the United States Fish commission at Central station, Washington, D. C. Bulletin, 1890 (1892), vol. X, p. 1–12, illus., IV pl. *Doc. 186 issued Feb. 11, 1892.* 7–1837

BIOLOGICAL STATIONS.

[The **American** representation at the Naples Zoological station.] Bulletin, 1885 (1885), vol. V, p. 466.

Dohrn, Anton, i. e. Felix Anton: The zoological station at Naples, Italy. Bulletin, 1883 (1883), vol. III, p. 433–435 incl. tables. F18–166

Evermann, Barton Warren: [The necessity of a biological station in Florida.] Bulletin, 1897 (1898), vol. XVII, p. 207–208.

McIntosh, W. C.: Fish-cultural investigations at St. Andrews Marine Laboratory, Scotland. Bulletin, 1893 (1894), vol. XIII, p. 241–256. *Doc. 261 issued June 26, 1894.* F12–183

Meek, Seth Eugene: The utility of a biological station on the Florida coast in its relation to the commercial fisheries. Bulletin, 1897 (1898), vol. XVII, p. 181–183. *Doc. 367 issued Aug. 8, 1898.* F12–110

Smith, Hugh McCormick: Notes on Biscayne Bay, Florida, with reference to its adaptability as the site of a marine hatching and experiment station. Appendix 2, Report, 1895 (1896), p. 169–191. *Doc. 333 issued June 8, 1897.* F11–196

Taylor, W. Edgar: Establishment of a biological station on the Gulf of Mexico. Bulletin, 1897 (1898), vol. XVII, p. 185–188. *Doc. 368 issued Aug. 8, 1898.* F12–110

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Feddersen, Arthur Frederik: Abstract of an article from the "Nordisk tidsskrift for fiskeri," 1878, entitled "Observations on fishery expositions," etc. Report, 1878 (1880), p. 43–45. F16–153

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Ravenel, William de Chastignier: Report of the representatives of the U. S. Fish commission at the Cotton states and international exposition at Atlanta, Georgia, in 1895. Report, 1896 (1898), p. 147–167, pl. 11–21. *Doc. 338 issued June 14, 1897.* F11–175

BUFFALO: PAN-AMERICAN EXPOSITION.

Ravenel, William de Chastignier: The Pan-American exposition. Report of the representative of the U. S. Fish commission. Report, 1901 (1902), p. 289–351, pl. 6–20. *Doc. 508 issued Oct. 27, 1902.* F11–26

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Bean, Tarleton Hoffman: Report of the representatives of the U. S. Fish commission at the World's Columbian exposition. Report, 1894 (1896), p. 177–196, pl. 1–5. *Doc. 311 issued Nov. 30, 1896.* F11–186

CINCINNATI: CENTENNIAL EXPOSITION.

Collins, Joseph William: Report upon the participation of the U. S. Fish commission in the Centennial exposition held at Cincinnati, Ohio, in 1888. Report, 1888–89 (1892), p. 869–885, pl. XC. *Doc. 191 issued 1892.* F12–229

NASHVILLE: TENNESSEE CENTENNIAL EXPOSITION.

Ravenel, William de Chastignier: Report upon the exhibit of the United States Commission of fish and fisheries at the Tennessee Centennial exposition in 1897. Report, 1898 (1899), p. 329–339, pl. 37. *Doc. 407 issued Mar. 28, 1899.* F11–118

ST. LOUIS: LOUISIANA PURCHASE EXPOSITION.

Ravenel, W. de C.: The United States Commission of fish and fisheries, and its exhibit at the Louisiana Purchase exposition, St. Louis, Mo., 1904. 54 p. (Gibson, Washington.)

LONDON: INTERNATIONAL FISHERY EXPOSITION.

Benecke, Barthold Adolph: The results of the London Fisheries exhibition in their practical value for Germany. Report, 1884 (1886), p. 1185–1204. F18–141

Ljungman, Axel Vilhelm: Sweden at the great International fishery exposition at London, 1883. Bulletin, 1883 (1883), vol. III, p. 231–239. F18–128

Lowell, James Russell: Success of the United States exhibit at the London International fisheries exhibition. Bulletin, 1883 (1883), vol. III, p. 447–448. F18–180

——— Thanks of the executive committee of the London International fisheries exhibition for the participation by the United States. Bulletin, 1884 (1884), vol. IV, p. 291–292. F18–315

U. S. Bureau of Fisheries: [Great International fisheries exhibition: catalogues.]

- a. Preliminary catalogue and synopsis of the collections exhibited by the United States Fish commission and by special exhibitors. With a concordance to the official classification of the exhibition. 107 p. *Doc. 54 issued May 25, 1883.* F12–291
- b. Collection of economic crustaceans, worms, echinoderms and sponges, by Richard Rathbun. 31 p. *Doc. 55 issued May 22, 1883.* F12–292
- c. Catalogue of the aquatic and fish-eating birds exhibited by the United States National museum, by Robert Ridgway. 48 p. *Doc. 56 issued May 22, 1883.* F20–140
- d. Catalogue of the economic mollusca and the apparatus and appliances used in their capture and preparation for market, exhibited by the United States National museum, by Francis Winslow. 86 p. *Doc. 57 issued June 14, 1883.* F12–293
- e. The whale fishery and its appliances, by James Temple Brown. 116 p. *Doc. 58 issued June 14, 1883.* 8–27229
- f. Catalogue of the collections of fishes exhibited by the United States National museum, by Tarleton H. Bean. 124 p. *Doc. 59 issued June 30, 1883.* F12–295
- g. Descriptive catalogue of the collection illustrating the scientific investigation of the sea and fresh waters, by Richard Rathbun. 109 p. *Doc. 69 issued Apr. 19, 1884.* F12–296
- h. Catalogue of the aquatic mammals exhibited by the United States National museum, by F. W. True. 22 p. *Doc. 74 issued May 9, 1884.* F12–297

EDINBURGH: INTERNATIONAL FISHERIES EXHIBITION.

Leonard, J. A.: Plan of the International fisheries exhibition to be held at Edinburgh, Scotland, and a list of prizes to be awarded. Bulletin, 1881 (1882), vol. I, p. 390–394. F20–128

——— A report on the Edinburgh fisheries exhibition. Bulletin, 1882 (1883), vol. II, p. 80–82. F18–77

Official papers relating to the proposed International fisheries exhibition at Edinburgh in 1882. Bulletin, 1881 (1882), vol. I, p. 130–132. F18–29

BERLIN: INTERNATIONAL FISCHEREI-AUSSTELLUNG, 1880.

Haack, Hermann: A German view of the American section in the Berlin Fishery exhibition. Bulletin, 1881 (1882), vol. I, p. 57–58. F18–18

The **United States** exhibit at the Berlin International fishery exposition of 1880. Tr. by Herman Jacobson. 1884, p. 53–58. F16–319

FISHERY CONGRESSES.

WORLD'S FISHERIES CONGRESS, CHICAGO, 1893.

World's Fisheries Congress, Chicago, 1893: Report and papers of the World's fisheries congress, held at Chicago, October 16 to 19, 1893. Bulletin, 1893 (1894), vol. XIII, 462 p., illus., 41 pl. (partly col.). F12–183

Contents.—1. Report of the secretary of the general committee, by T. H. Bean. 2. Address of the chairman of the general committee on the World's fisheries congress, by M. McDonald. 3. The assimilation of the fishery laws of the Great Lakes, by G. A. MacCallum. 4. The decrease of food-fishes in American waters and some of the causes, by A. M. Spangler. 5. The sea and coast fisheries, by D. T. Church. 6. Our ocean fishes and the effect of legislation upon the fisheries, by J. M. K. Southwick. 7. The past, present, and future of trout-culture, by W. L. Gilbert. 8. The relation of scientific research to economic problems, by G. B. Goode. 9. Biological research in relation to the fisheries, by J. A. Ryder. 10. On the influence of light on the periodical depth-migrations of pelagic animals, by J. Loeb. 11. The investigation of rivers and lakes with reference to the fish environment, by B. W. Evermann. 12. The habits and development of the lobster, and their bearing upon its artificial propagation, by F. H. Herrick. 13. The origin of the food of marine animals, by W. K. Brooks. 14. Atmospheric and other influences upon the migration of fishes, by J. J. Armistead. 15. Some observations concerning fish parasites, by E. Linton. 16. On the food of the menhaden, by J. I. Peck. 17. Some plankton studies in the Great Lakes, by J. E. Reighard. 18. The aquarium of the United States Fish commission at the World's Columbian exposition, by S. A. Forbes. Description of the fresh and salt water supply and pumping plants used for the aquarium, by I. S. K. Reeves. Observations and experiments on Saprolegnia infesting fish, by G. P. Clinton. Report on a parasitic protozoan observed on fish in the aquarium, by C. W. Stiles. 19. Opening remarks of the chairman of the fish-cultural section of the Fisheries congress, by E. G. Blackford. 20. Statistical review of fish-culture in Europe and North America, by N. Borodine. 21. Some notes about American fish-culture, by O. Nordqvist. 22. Fish-culture in Michigan, by H. Post. 23. History and methods of whitefish culture, by F. N. Clark. 24. Methods employed at Craig Brook station in rearing young salmonoid fishes, by C. G. Atkins. 25. The propagation of black bass in ponds, by W. F. Page. 26. Fish and fishing in British Guiana, by J. J. Quelch. 27. Fish-cultural investigations at St. Andrews marine laboratory, Scotland, by W. C. McIntosh. 28. Description of the marine hatchery at Dunbar, Scotland, by T. W. Fulton. 29. The past, present, and future of the oyster industry of Georgia, by A. Oemler. 30. Deep-water oyster culture, by H. C. Rowe. 31. Breeding natural food artificially for young fish artificially hatched, by A. N. Cheney. 32. What we know of the lobster, by F. Mather. 33. Remarks on the maintenance and improvement of the American fisheries, by H. M. Smith. 34. Reforms and improvements suggested for the fisheries of Great Britain and Ireland, by J. Lawrence-Hamilton. 35. Foul fish and filth fevers, by J. Lawrence-Hamilton. 36. Recent experiments in sturgeon hatching on the Delaware River, by B. Dean. 37. The fisheries of Canada, by L. Z. Joncas. 38. The fishing industry of Lake Erie, past and present, by C. M. Keyes. 39. The fisheries of the Virginia coast, by J. T. Wilkins. 40. Notes on the Irish mackerel fisheries, by W. S. Green. 41. Past and future of the fur seal, by J. Stanley-Brown. 42. Notes on the fisheries and fishery industries of Puget Sound, by J. G. Swan. 43. Fish nets: some account of their construction and the application of the various forms in American fisheries, by C. H. Augur. 44. Statistics of the fisheries of the United States, by H. M. Smith. 45. The fisheries of Japan, by the Japanese Bureau of Agriculture. 46. On pearls, and the utilization and application of the shells in which they are found in the ornamental arts, as shown at the World's Columbian exposition, by G. F. Kunz.

NATIONAL FISHERY CONGRESS, TAMPA, 1898.

National Fishery Congress, Tampa, 1898: Proceedings and papers of the National fishery congress, held at Tampa, Florida, January 19-24, 1898. Bulletin, 1897 (1898), vol. XVII, p. 145-371, illus., pl. 10-31. F12-110

Contents.—Proceedings of the congress. Methods of plankton investigation in their relation to practical problems, by J. Reighard. The importance of extended scientific investigation, by H. C. Bumpus. The utility of a biological station on the Florida coast in its relation to the commercial fisheries, by Seth E. Meek. Establishment of a biological station on the Gulf of Mexico, by W. E. Taylor. Some notes on American shipworms, by C. P. Sigerfoos. An economical consideration of fish parasites, by Edwin Linton. The fish fauna of Florida, by B. W. Evermann. The lampreys of central New York, by H. A. Surface. The protection of the lobster fishery, by F. H. Herrick. The Florida commercial sponges, by H. M. Smith. On the feasibility of raising sponges from the egg, by H. V. Wilson. The Hudson River as a salmon stream, by A. N. Cheney. A plea for the development and protection of Florida fish and fisheries, by J. A. Henshall. International protection for the denizens of the sea and waterways, by B. W. James. The restricted inland range of shad due to artificial obstructions and its effect on natural reproduction, by C. H. Stevenson. The green turtle and the possibilities of its protection and consequent increase on the Florida coast, by Ralph M. Munroe. Some factors in the oyster problem, by H. F. Moore. The oyster grounds of the west Florida coast: their extent, condition, and peculiarities, by F. Swift. The oysters and oyster beds of Florida, by John G. Ruge. The Louisiana oyster industry, by F. C. Zacharie. The oyster-bars of the west coast of Florida: their depletion and restoration, by H. A. Smeltz. Notes on the fishing industry of eastern Florida, by J. Y. Detwiler. Oysters and oyster-culture in Texas, by I. P. Kibbe. The methods, limitations, and results of whitefish culture in Lake Erie, by J. J. Stranahan. A brief history of the gathering of fresh-water pearls in the United States, by G. F. Kunz. The red snapper fisheries: their past, present, and future, by A. F. Warren. Some brief reminiscences of the early days of fish-culture in the United States, by L. Stone. The relations between State fish commissions and commercial fishermen, by W. E. Meehan. Possibilities for an increased development of Florida's fishery resources, by J. N. Cobb. The utility and methods of mackerel propagation, by J. P. Moore. The large-mouthed black bass in Utah, by John Sharp. Florida fur-farming, by J. M. Willson, jr. Index.

INTERNATIONAL FISHERY CONGRESS, FOURTH, WASHINGTON, 1908.

International Fishery Congress, Fourth, Washington, 1908: Proceedings of the Fourth International fishery congress: Organization and sessional business, papers, and discussions. Held at Washington, U. S. A., September 22 to 26, 1908. Bulletin, 1908 (1910), vol. XXVIII, 2 parts, illus., CLVI pl. (partly col. 2 fold.). 11-5437

Contents.—Pt. 1. Organization and sessional business. International regulations of the fisheries on the high seas [3 papers], by O. T. Olsen, C. E. Fryer, C. H. Stevenson. Work of the International fisheries commission of Great Britain and the United States, by D. S. Jordan. Some reasons for failure of fish protective legislation and some suggested remedies, by O. M. Dennis. National aspects of angling and the protection of game fishes, by H. W. Perce. Sport fishing in California and Florida, by C. F. Holder. Lobsters and the lobster problem in Massachusetts, by G. W. Field. A method of lobster culture, by A. D. Mead. Sea mussels and dogfish as food, by I. A. Field. The wholesomeness of oysters as food, by H. C. Rowe. Effects of menhaden fishing upon the supply of menhaden and of the fishes that prey upon them, by W. E. Hathaway. Effects of the menhaden and mackerel fisheries upon the fish supply, by W. C. Kendall. An improved and practical method of packing fish for transportation, by A. Sölling. A process for preserving the pearl-oyster fisheries and for increasing the value of the yield of pearls, by J. I. Solomon. Fur seals and the seal fisheries, by C. H. Townsend. Economic conditions of the fisheries in Italy, by Guido Rossati. The fisheries and the guano industry of Peru, by R. E. Coker. The fisheries of China, by Wei-Ching W. Yen. The fisheries of Japan, from a geographical standpoint, by T. Kitahara. Gold fish and their culture in Japan, by Shinnosuke Matsubara. Commercial sponges and the sponge fisheries, by H. F. Moore. The abuse of the scaphander in the sponge fisheries, by Ch.

Flégel. A practical method of sponge culture, by H. F. Moore. Sponge culture, by Jules Cotte. Experiments in the artificial propagation of fresh-water mussels, by George Lefevre and W. C. Curtis. A plan for promoting the whitefish production of the Great Lakes [3 papers], by S. W. Downing, F. N. Clark, Paul Reighard.

Pt. 2. Fish-cultural practices in the Bureau of Fisheries, by J. W. Titcomb. A new principle of aquiculture and transportation of live fishes, by A. D. Mead. Method of cultivating rainbow trout and other Salmonidæ, by C. L. Paige. Possible expansion of shad-hatchery work, by S. G. Worth. The comparative value of foods for rainbow trout and other salmonoids, by C. L. Paige. Apparatus and methods employed at the marine fish hatchery at Flödevig, Norway, by G. M. Dannevig. The utility of sea-fish hatching, by G. M. Dannevig. Propagation and protection of the Rhine salmon, by P. P. C. Hoek. Fishes in their relation to the mosquito problem, by W. P. Seal. Foods for young salmonoid fishes, by C. G. Atkins. Fresh-water shrimp, a natural fish food, by S. G. Worth. The cultivation of the turbot, by R. Anthony. The treatment of fish-cultural waters for the removal of algæ, by M. C. Marsh and R. K. Robinson. Notes on the dissolved content of water in its effect upon fishes, by M. C. Marsh. Cause of disease in young salmonoids, by Eugene Vincent. Radical prevention of *Costia necatrix* in salmonoid fry, by Johann Franke. Treatment of fungus on fishes in captivity, by L. B. Spencer. Methods of combating fungus on fishes in captivity, by C. F. Holder. A new method of combating fungus on fishes in captivity, by Paul Zirzow. Eighteen months' experience with a disease of brook trout, by Albert Rosenberg. American fishes in Italy, by Giuseppe Besana. Acclimatization of American fishes in Argentina, by E. A. Tulian. The introduction of American fishes into New Zealand, by L. F. Ayson. Naturalization of American fishes in Austrian waters, by Franz von Pirko. Causes of degeneration of American trouts in Austria, by Johann Franke. New and improved devices for fish culturists, by A. E. Fuller. A device for counting young fish, by R. K. Robinson. A method of transporting live fishes, by C. F. Holder. A method of measuring fish eggs, by H. von Bayer. An improvement in hatching and rearing boxes, with notes on continuous feeding of the fry of Salmonidæ, by G. E. Simms. Devices for use in fish hatcheries and aquaria, by Eugene Vincent. New methods of transporting eggs and fish, by W. S. Kincaid. Fishways, by H. von Bayer. A plea for observation of the habits of fishes and against undue generalization, by Theodore Gill. The habits and life history of the toadfish (*Opsanus tau*), by E. W. Gudger. Methods of studying the habits of fishes and recording their life histories; with an account of the breeding habits of the horned dace, by Jacob Reighard. A method of observing the habits and recording the life histories of fishes, by C. F. Holder. Effects of changes in the density of water upon the blood of fishes, by G. G. Scott. Internal parasites of the Sebago salmon, by H. B. Ward. Notes on the flesh parasites of marine food fishes, by Edwin Linton. Structure and functions of the ear of the squeteague, by G. H. Parker. An intensive study of the fauna and flora of a restricted area of sea bottom, by F. B. Sumner. Development of sponges from tissue cells outside the body of the parent, by H. V. Wilson. Gases dissolved in the waters of Wisconsin lakes, by E. A. Birge. Volumetric studies of the food and feeding of oysters, by H. F. Moore. A plan for an educational exhibit of fishes [2 papers], by C. F. Holder and R. W. Miner. Outline for an educational exhibit of fishes, by F. A. Lucas. A method of preparing fish for museum and exhibition purposes, by Dwight Franklin. New method of preparing fishes for museum exhibit, by J. D. Figgins. The United States Bureau of Fisheries: its establishment, functions, organization, resources, operations, and achievements, by H. M. Smith. General index.

Part 13.—UNCLASSIFIED

Part 13.—UNCLASSIFIED.

Baird, Spencer Fullerton: Purchase of Professor Poey's Ichthyologia Cubana by the Spanish government. Bulletin, 1883 (1883), vol. III, p. 439. F18–169

Boeck, G.: How to strengthen the dunes. Bulletin, 1885 (1885), vol. V, p. 38–40. F18–374

Ffennel, Henry: [What fish sometimes swallow.] Bulletin, 1885 (1885), vol. V, p. 78.

Garman, Samuel: In regard to the "sea-serpent" of literature. Bulletin, 1884 (1884), vol. IV, p. 128. F18–246

Hanna, S. W.: Description of an eel-like creature taken in a net at New Harbor, Maine, in 1880. Bulletin, 1883 (1883), vol. III, p. 407–410, illus. F18–153

Hartung, G.: An account of the Loffoden Islands of Norway. Report, 1877 (1879), p. 559–564. F16–109

Herndon, C. G.: Sanitary report on old Providence Island, United States of Colombia. Bulletin, 1884 (1884), vol. IV, p. 412–414. F18–352

Johnson, George A.: A mud slough on the Grand Banks. Bulletin, 1885 (1885), vol. V, p. 291–292. F18–444

Kidder, Jerome H.: Hints for emergencies. Prepared for the use of field parties of the United States Fish commission. [1877.] F11–208

——— The Bower-Barff rustless iron. Bulletin, 1885 (1885), vol. V, p. 151–154. F18–394

Magie, William Francis: [Report upon atmospheric electricity.] Bulletin, 1889 (1891), vol. IX, p. 408–410.

Marquette, George R.: Extraordinary floods in the Potomac River. Bulletin, 1881 (1882), vol. I, p. 258. F18–46

Michigan, State Board of Fish Commissioners: Minute upon the death of Oren M. Chase, George W. Armstrong, and Charles H. Brownell. Bulletin, 1884 (1884), vol. IV, p. 83–85. F18–231

Morris, Alfred: [A sea-monster.] Bulletin, 1885 (1885), vol. V, p. 78–79.

Proctor, Richard Anthony: A marine monster. Bulletin, 1884 (1884), vol. IV. p. 55–56. F18–218

——— Monster sea-serpents. Bulletin, 1885 (1885), vol. V, p. 325–328. F18–466

Reighard, Jacob Ellsworth: The photography of aquatic animals in their natural environment. Bulletin, 1907 (1908), vol. XXVII, p. 41–68, illus., pls. *Doc. 635 issued Aug. 22, 1908.* 8–35640

Schufeldt, Robert Wilson: Experiments in photography of live fishes. Bulletin, 1899 (1901), vol. XIX, 5 p. 9 pl. *Doc. 424 issued Dec. 13, 1899.* F12–40

Smiley, Charles Wesley: A list of the names and addresses of the fish commissioners of the various States of the United States, and of the superintendents of hatcheries, corrected to June 1, 1883, with some indication of the limits of the terms upon which they are now serving. Bulletin, 1883 (1883), vol. III, p. 117–122. F18–118

——— A list of the names of all persons who have been appointed commissioners of fisheries of the various States of the United States, with their addresses, and the dates of their terms of service. Bulletin, 1883 (1883), vol. III, p. 123–127. F18–119

Swan, J. G.: [Construction of canoes made by Makah Indians.] Bulletin, 1890 (1892), vol. X, p. 19–20.

Wilcox, W. A. [A vessel struck four times by a swordfish.] Bulletin, 1886 (1887), vol. VI, p. 143–144.

——— [A man killed by a swordfish.] Bulletin, 1886 (1887), vol. VI, p. 411–412.

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